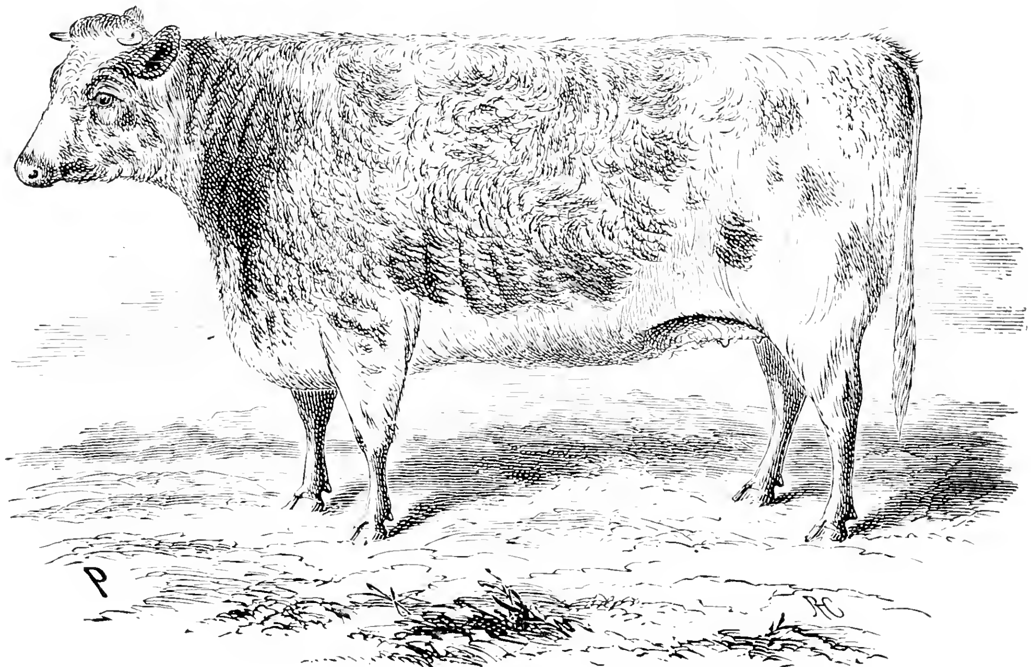
Library
of the
Secretary
of the
Nat'l Ex. Station.
Mar. 22. [illegible]



SHORT-HORN HEIFER "LUCY," 2 Years Old.—OWNED BY J. A. HARWOOD, LITTLETON

See Preface to Abstract.

SEVENTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Massachusetts Board of Agriculture,

WITH AN APPENDIX

CONTAINING

REPORTS OF DELEGATES APPOINTED TO VISIT THE COUNTY EXHIBITIONS,

AND ALSO

RETURNS OF THE FINANCES OF THE AGRICULTURAL SOCIETIES

FOR

1869.

BOSTON:
WRIGHT & POTTER, STATE PRINTERS,
79 MILK STREET (CORNER OF FEDERAL).
1870.

STATE BOARD OF AGRICULTURE.

1870.

MEMBERS EX OFFICIIS.

His Excellency WILLIAM CLAFLIN.
His Honor JOSEPH TUCKER.
Hon. OLIVER WARNER, *Secretary of the Commonwealth.*
WILLIAM S. CLARK, *Pres't Mass. Agricultural College.*

APPOINTED BY THE GOVERNOR AND COUNCIL.

	Term Expires.
MARSHALL P. WILDER, *of Boston*, ...	1871.
JAMES F. C. HYDE, *of Newton*, ...	1872.
LOUIS AGASSIZ, *of Cambridge*, ...	1873.

CHOSEN BY THE COUNTY SOCIETIES.

Massachusetts, ...	LEVERETT SALTONSTALL, of Newton,	. 1871
Essex, ...	GEORGE B. LORING, of Salem, . . .	. 1872
Middlesex, ...	JOHN B. MOORE, of Concord, . . .	. 1873
Middlesex North, ...	ASA CLEMENT, of Dracut, ...	. 1871
Middlesex South, ...	JOHN JOHNSON, of Framingham, .	. 1872
Worcester, ...	THOMAS W. WARD, of Shrewsbury, .	. 1872
Worcester West, ...	JOHN T. ELLSWORTH, of Barre, .	. 1872
Worcester North, ...	LEWIS H. BRADFORD, of Fitchburg, .	. 1872
Worcester North-West, . . .	CHARLES C. BASSETT, of Athol, .	. 1871
Worcester South, ...	NEWTON S. HUBBARD, of Brimfield,	. 1871
Worcester South-East, . . .	WILLIAM KNOWLTON, of Upton, .	. 1873
Hampshire, Franklin and Hampden,	A. PERRY PECK, of Northampton, .	. 1873
Hampshire, ...	JOHN A. MORTON, of Hadley, . . .	. 1871
Highland, ...	GEORGE T. PLUNKETT, of Hinsdale,	. 1872
Hampden, ...	WILLIAM BIRNIE, of Springfield, .	. 1873
Hampden East, ...	HIRAM CONVERSE, of Palmer, . . .	. 1873
Union, ...	E. W. BOISE, of Blandford, ...	. 1871
Franklin, ...	IMLA K. BROWN, of Bernardston, .	. 1871
Berkshire, ...	ANDREW J. BUCKLIN, of South Adams,	. 1873
Hoosac Valley, ...	NAHUM P. BROWN, of Florida, . . .	. 1873
Housatonic, ...	RICHARD GOODMAN, of Lenox, .	. 1873
Norfolk, ...	ELIPHALET STONE, of Dedham, .	. 1871
Hingham, ...	ALBERT FEARING, of Hingham, . .	. 1873
Bristol, ...	AVERY P. SLADE, of Somerset, . . .	. 1872
Bristol Central, ...	NATHAN DURFEE, of Fall River, .	. 1873
Plymouth, ...	CHARLES G. DAVIS, of Plymouth, .	. 1872
Marshfield, ...	GEORGE M. BAKER, of Marshfield, .	. 1873
Barnstable, ...	GEORGE A. KING, of Barnstable, .	. 1871
Nantucket, ...	JAMES THOMPSON, of Nantucket, .	. 1872
Martha's Vineyard, . . .	JOHN PIERCE, of Edgartown, . . .	. 1871

CHARLES L. FLINT, *Secretary.*

SEVENTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

BOARD OF AGRICULTURE.

To the Senate and House of Representatives of the Commonwealth of Massachusetts.

The past year furnishes a striking illustration of the dependence of the farmer upon the vicissitudes of the season. A spring of more than usual moisture started vegetation into a vigorous and rapid growth, very favorable to the hay and other early crops. The barns were well stored, and had it not been for the gales of September which visited some sections of the State with disastrous violence, and the floods of October, more general in their destruction, it would have been a year of unusual prosperity. Still, notwithstanding these drawbacks, the general record of the year is one upon which we may dwell with satisfaction.

The most serious obstacle with which the New England farmer has to contend is the want of free and open markets, opening a more direct trade between the producer and the consumer. The prices which the consumer has to pay for farm products are high enough, perhaps, but they do not find their way into the farmer's pocket. As a general rule, probably less than fifty per cent. of what an article of farm produce costs the consumer in the retail market reaches the hands of the farmer who produced

it. This fact which might be established beyond dispute by innumerable illustrations, has had, and is having, a depressing effect upon our agriculture. It is driving young men from the farm and reducing the taxable valuation of our strictly farming districts. It has contributed largely to create the impression in the popular mind that farming does not pay, that the tillage of the soil offers less inducement than most other pursuits.

Our great markets, which fix and control prices, are subject to the control of municipal regulation. The only remedy would seem to be a radical change in our market system which must be a work of time.

The stock of the farms has been generally healthy. The most noteworthy exception has been that to which allusion is made in the following

REPORT OF THE COMMISSIONERS ON CONTAGIOUS DISEASES AMONG CATTLE.

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts.

The undersigned Commissioners on Contagious Diseases among Cattle, in presenting their Annual Report, feel that they have occasion to congratulate the legislature and the people of the Commonwealth, that no contagious disease has ravaged and destroyed our herds as in some former years. The Pleuro-pneumonia seems to have been eradicated. At least no cases of it have come to the knowledge of the Commissioners during the year past, and we would fain hope to be exempt from its scourge in the long future. The Cattle Plague, or Spanish Fever, which was imported from the West to our State last year, creating wide-spread panic and alarm, did not as it was feared it might, reappear with the warm season, and the influx of Western and South-Western cattle. Stringent laws were passed and enforced by the legislatures of several of the Western States, which prevented all driving of Texas cattle to the Northern and Eastern markets. By this means the immense herds along the great routes of travel, from the Kansas border to the seacoast, have been kept free of the plague, and our own cattle protected from its ravages. Although, as a general rule, the business of stock husbandry in the State, during the year, has been successful and prosperous, and the herds exempt

from prevailing disease, it has not been universally so. On the 23d of October last, the Commissioners received a communication, through the secretary of state, from the selectmen of Great Barrington, conveying the information that a "malignant and fatal" disease was prevailing among the cattle of portions of that and the adjoining town of Egremont, and asking for the aid and coöperation of the Commissioners in dealing with and exterminating it. Correspondence was entered into with the town authorities, and it appearing that the disease did not abate, and that that community was becoming much alarmed about it, one of the Commissioners visited those towns on the 5th of November, to assist in investigating the matter. By this examination it appeared, that about the 20th of July, a cow belonging to Mr. D. C. Milliard sickened and died in a very unusual manner, but without attracting special attention. He lost another in August in the same manner, and yet another in September. Early in October, or soon after the great freshet, and when the cattle were quite generally allowed to run on the flowed meadows of Green River, unconfined by fences, (which had been swept away by the flood,) many other cattle, the property of adjoining farmers, sickened and died, apparently with the same disease that had destroyed Mr. Milliard's. At the time of the visit of the Commissioner, thirty had died and others were sick. No rational explanation could be given of the cause of the disease, and no remedies discovered to stay its progress or cure the diseased animals. It was found that in some respects the disease resembled the Spanish Fever; in others it was entirely unlike it. The animals affected by it generally gave no signs of disease until six or eight hours before death, and in some cases died almost before they were known to be sick. They all died in terrible agony and with convulsions. All the post mortem examinations showed precisely the same condition of the internal organism,—all the organs of the chest apparently healthy, and those of the abdomen, with the exception of the spleen and bladder. The spleen was in all cases very much enlarged, inflamed and softened, and its texture destroyed. It could not be ascertained that the disease was contagious. One animal would sicken and die, while others in constant contact with it would remain perfectly healthy. The peculiarities of the disease and its progress appeared to be such, that

the Commissioner did not deem it best to isolate the diseased animals until after further and more thorough examinations had been made. Accordingly, Dr. Richard Beebe, a physician of Egremont, was engaged to take the case in hand and make an investigation of the matter, and to report to the Commissioners the results of the investigation. He commenced his labor at once, and on the 24th of December, forwarded to us a history of the progress of the disease from its commencement to that date, its symptoms, and the results of curative efforts. He says: —

"The same day I saw you at Mr. Clark's, when I was going home, about 5 o'clock P. M., I discovered a cow in D. C. Milliard's lot, some little distance from the others; she was eating grass, but she would take two or three bites quite rapidly and then chew a few moments in the same way, and then stop altogether, with her head within six inches of the ground, as if listening to some peculiar sound, and then go on again as above stated. This was about 5 o'clock. In about twenty minutes after I passed, Milliard saw something wrong about the cow, and drove her into the stable. She went directly to eating old hay, and continued to do so for some time, when his man milked her and found she gave no milk of any consequence. Still the man thought she was not sick; told Milliard he did not think she was sick. About half-past six Milliard said to his man he thought the cow did not look right and wished him to go for me. He came to my place, about half a mile, and went directly back; only gone about half an hour, and when he got home the cow was dead, and he says he left her chewing her cud.

"I did not make an examination till morning (Sunday, Nov. 4); found stomach apparently healthy, small intestines and bladder ulcerated and quite full of thin, bloody water. When I came to the spleen it retained its shape, but the moment I touched it, it broke and run like water. I could not do anything about weighing it; judged it would have weighed eight lbs.; there was no coagula about any of the blood in any part of the animal, not even the cavities; there did not appear to be any fibrine in the blood. Milliard drew the cow eighty rods or so from the barn to bury her, with a yoke of oxen, and when he took the oxen off, he said, 'I think that ox is sick,' pointing to one of them. I looked at him; he did appear somewhat stupid; his pulse was 50, his horns cold; he was standing humped up, his hind legs too far under him, respiration too rapid, and with that peculiar drawing up of the flank — sudden jerking

and gulping—which characterizes the breathing of all, or most all that have been sick.

"I then prepared the following prescription :—

"Rosin pulvis, elm bark pulvis, ginger root pulvis, cayenne pepper pulvis, each one dram; cincho quinine, two scruples. Mix in half pint warm water and give every two to four hours.

"They gave the ox two doses, four hours apart; then Milliard learned of some other remedy, and gave the ox, but he died in the same manner as did the others, and with the same general appearance. I would here state that all the cattle that have died, that any one has seen, have died in most terrible pain and convulsions.

"The next cow sick was owned by a Mr. Jones; gave the above prescription and she got well; the next was H. D. Hollenbeck's, found dead in the morning; did not know as she was sick. I examined her Nov. 7, and found the same things in all respects as far as disease, like Milliard's. Next was G. M. Hollenbeck's; died without treatment; showed same condition of things. Next was H. D. Hollenbeck's, discovered in the afternoon of November 10; gave medicine immediately, took four quarts blood, reaction came on, her horns became so hot that they were uncomfortable to hold in the hand; gave medicine every four hours; cow recovered about the fourth day. I did not think the bleeding did any good. She began eating and increasing in her milk. In all cases of milch cows, loss of milk is a universal and constant symptom.

"November 16, D. C. Milliard had a cow taken sick; gave the medicine and she recovered. November 22, George Lee, of Ashley Falls, lost a cow in the same way; died in about four hours from first symptoms. I did not see her nor did she take any medicine. The man who opened her said the stomach was not, in his opinion, healthy; the spleen was diseased; he described a falling off of the mucous membrane of the stomach, or rather an adherence of the epithelial covering of the mucous membrane to the contents of the stomach—which I discovered in all cases, and which I think is post mortem. I think, from what I can learn from the man, that the cow died with the same disease. November 29, Gilbert Ford lost a cow; found dead in the morning; did not know she was sick, only that she had a peculiar breathing the night before, of which Ford thought nothing. The next day he found another cow breathing in the same way, and sent for me. We gave the medicine; she was sick in the same way as others and very bad, but she recovered after a few days. December 18, Rawson Brown found a cow sick; sent for me; she was growing rapidly worse; he did not think it of much use to give anything more, for he had got and given already two doses

2

of my medicine, but we increased the dose to almost double the amount of quinine, and gave every four hours, and she came out of it all right. This Brown lost a cow, I think, in September with this disease, and I think she was a dry cow; at any rate this one was, and he was feeding her to fat.

"This disease has been so peculiar in its commencement and progress, that I can't say very much to give you light on the subject. I have told you almost all the symptoms in these cases, except that in perhaps one-half the cases there is a great desire and good deal of effort to urinate, but with no great amount of urine; one of the cows, after she had recovered a few days, had a large abscess on her side, which indicated a bad state of the blood.

"I cannot make out that the disease is really contagious. Most of the cases, however, are in herds that have run on adjoining farms; and then, again, there are cases that have not been near any of the disease, as any one knows of. D. C. Milliard says his oxen had not been with or near his cows till after the third one died, and that they had not run on the Green River at all, and had not been with the cows more than three weeks, and he thinks they must have taken the disease from the cows; but the other ox has not been sick, nor have any more of his cattle been sick. Again, there are herds of cows right below him that have been exposed by his cows, and yet have not been sick.

"It appears to me just like typhoid fever in its coming to a town or neighborhood; some families will have fever, perhaps all, and yet again not more than one; maybe three or four families will have it adjoining, and then again skip two or three; and like such fevers it appears to be a poison of the blood, and in all probability the poison is taken into the system sometime before they are sick, and they are taken sick in (so far as danger to life is concerned) proportion to the amount of poison, and its deleterious effects upon the system. There appears to be a loss of fibrine about the blood of all I have examined, but still I cannot ascertain any cause for the disease that gives me the least satisfaction, nor why the cows in our vicinity should be diseased more than in any other parts of our towns or county. I only know this, that such is the fact, and that it does appear to be of a malarious character; and I do believe that the medicine I have given, in a case that has got twenty-four hours to live (or in other words, that would live twenty-four hours without treatment), will cure all or almost all, if properly given and attended to."

In consequence of the favorable report of Dr. Beebe, in relation to the curability of the disease, and the probability that it was not contagious, the Commissioners did not deem it necessary to take any further measures for its suppression. It continued to decline, and at this date no cases of it are known to exist. The disease in its progress has entailed great losses on the farmers of that section of the State, and filled them with fear for the future, but there is apparently no occasion for alarm, or reason for the recurrence of the disease, other than what may exist in its epidemic or malarious character.

For the Commissioners,

LEVI STOCKBRIDGE.

PUBLIC MEETING OF THE BOARD

AT PITTSFIELD.

The Annual Meeting of the State Board of Agriculture, was held at Pittsfield, in the chapel connected with Rev. Dr. Todd's church, on Tuesday, Wednesday, and Thursday, December 7th, 8th, and 9th.

The Board was called to order at 2 o'clock, on Wednesday, by ALEXANDER HYDE, of Lee, Chairman of the Committee on Meetings, who addressed the assembly, as follows:—

Gentlemen of the Massachusetts Board of Agriculture.

It is my duty as chairman of the committee of arrangements, to welcome you to Berkshire. I see that my friend Flint has put me down on the programme for an *address* of welcome. I did not consent to make a speech, but simply to say we are glad to see you. I know not what it is to feel big with a speech. I have labored sometimes to be delivered from a speech, but never to be delivered of one. I can say, however, most heartily, we are glad to see the Massachusetts Board of Agriculture in this ultramontane county. Individual members of the Board, we have frequently welcomed to our homes, but this is the first time we have been honored with a session of the body in the county. We regret that the season of the year is so unfavorable for the examination of our agriculture. Our hills look bleak in winter, and some of you may think that we

must keep our cattle on hemlock browse. Our down-east friends, accustomed to granite and silicious soils, have been a little incredulous as to the reports we have made of our premium crops. They could hardly believe that we could raise a hundred bushels of corn on an acre, and the same amount of oats, sixty bushels of rye, and four hundred of potatoes ; and a few years since the Secretary, with one or two members of the Board, came up to Berkshire, in the summer, to spy out the land, to see the crops growing, and to ascertain whether we told big stories, or did actually raise big crops. I took the Secretary and his companions to one of my neighbors who owns a farm of good strong land, and who had reported a crop of one hundred and nine bushels of oats to the acre. We found my neighbor in the hay field, and the Secretary asked him, "How do you know that you raised so many bushels on an acre?" The farmer stretched himself up at full length and replied, "I measured the land and weighed the oats myself." I never knew whether the Secretary was convinced or not, but if he was not, I was.

It is said that dwellers among mountains are always fond of their home, and are a little inclined to boast about it. The Swiss are proverbially homesick when absent from their mountain homes. You will excuse us, therefore, if we indulge in a little self-glorification. It is a trick we learned more than twenty years since, when we celebrated the centennial settlement of the county by a Berkshire jubilee, and called home the sons who had emigrated. We never knew till we heard the speeches of these wanderers, that we lived so near heaven on these Berkshire hills. We knew the scenery was good, but we had thought the soil a little rough, rocky and barren ; but they told us there was no place on earth so good to live and die in, as Berkshire. They probably thought so just at that moment, for it was a fair day in August, and we had had a good dinner, and were comfortably seated in a tent, with a good look-out upon the mountains, which were round about us, as they are round about Jerusalem. The pilgrims felt the associations of their youth called up, and their hearts burned within them as they spoke ; but I noticed that few of them ever came back to live and die in Berkshire. You have no such associations, and I fear may have a worse impression of our mountain home, as seen through the gloom of winter, than it deserves. We feel that

"the lines have fallen unto us in pleasant places, and that we have a goodly heritage." I have traversed the length and breadth of the county several times, have visited all the towns, and examined the farms and crops in most of them, and shared the hospitality of many of the citizens, and am free to say that, in my limited range of travel through the world, I have nowhere found more comfortable homes, better livers, nor more intelligent citizens. Much of our soil is rocky, and abounds in cold springs; but when the rocks are blasted out, and the superfluous water drained off, it produces luxuriant crops, especially of grass. We have long been famous for our butter and cheese dairies, and are now sending large quantities of milk to New York. I am sorry to add that in many of our mountain towns, the pastures have degenerated through neglect, and will not support the stock they once did. The mowing lots have received all the manure of the farm, and are in good condition; but the pastures, exhausted of the proper nutriment for grasses, have resolved on a rotation of crops, and are producing hard-hacks, brakes and alders. If any gentleman of the Board can stimulate our farmers to better care of their grazing lots, and teach us how to restore them to their former sweet herbage, he will be doing the county a good service.

Agriculture was formerly the leading pursuit of our population, but the war of 1812 brought in some manufactures, which have steadily increased in importance, till the products of the loom, the anvil, and the Fourdrinier machine, probably now outvalue those of the soil. A little local jealousy may have sometimes sprung up between these branches of industry, but it was entirely groundless, and they now move on in perfect harmony, mutually sustaining and encouraging each other. We have found that where manufactures flourish, there agriculture flourishes. There is no market equal to the home market. In and around our manufacturing villages population clusters, and real estate rises almost to fabulous prices, while on the hill towns the population is decreasing, and farms can be bought for less than the cost of the buildings, and in some cases for about the cost of the fences. It is said that half the population, and half the wealth of the county, are now concentrated in the four manufacturing towns of Adams, Pittsfield, Lee and Great Barrington. Our ancestors came from Cape Cod, Rhode

Island, and the towns in Connecticut bordering on the Sound, and apparently tired of a monotonous level country, went to the other extreme and settled first on the hills. A son of a Cape Cod farmer emigrating to Mt. Ephraim, as Berkshire was then called, was told by his father to pitch his tent on a hill and near some brook. The son did as he was ordered, and selected his home on one of our mountains, where he had a good look-out and plenty of water, but the location was too solitary for man's social nature, and a stone chimney and a few red-rose bushes mark the spot, where once stood a human habitation. We find many such old landmarks scattered among our hills, and it has become a question of some interest, what is to be the future of our hill towns. Is Mt. Ephraim to become Mt. Desolation? We believe not. Already there is a dawn of better times. Those who dwell in cities, and buy and sell and get gain, have found on our hills just the contrast they need with their city life, and our farmers are fitting up their homes, and entertaining their city cousins with bread and milk, and the songs of the whip-poor-will and nightingale to the tune of ten to fifteen dollars per week.

Our mountain towns also abound with springs, brooks and lakes, and are just the place where fish can be bred with great success. No other county in the State furnishes such facilities for fish-breeding as Berkshire, and we expect our learned associate will this week teach us how the thing is done. We have already made a beginning, and on one of the hill towns east of us, a farmer has made a reservoir covering some fifty acres, where he has trout weighing two to three pounds, which any one may catch, provided he will pay sixty cents per pound for the privilege of fishing. The time may come when trout may be one of the staple articles of export from the county, and an extra train may be required to carry our fish to New York, as is now necessary to transport our milk. "Ichabod" cannot be written on our mountain towns, if ichthyology can restore them to their former glory.

It is a great mistake to suppose that improved and large breeds of cattle cannot thrive on our mountain pastures. The Roan Duke made the Middlefield cattle famous throughout the State, and when he had served his day and generation in that town, he was transferred to the hills of Shelburne, where he did equally

good service, and where his posterity make the best herds of high grade Durhams that it has ever been my pleasure to see. The Middlefield and Shelburne farmers raised their broad-hipped Durhams mainly by the agency of grass, with little aid from grain. What one town has done, another may do. What two towns have done, all may do. As Joseph Anderson, who imported the Roan Duke into Shelburne, said to us last fall: "In order to have good cattle, we must have good land. My first effort when I took this old rough farm, was to improve the land. My crops acted on the stock, and the stock reacted on the crops, and the action and reaction have been continually progressing." This is the right style for farming, both for hill and valley.

But I will not trespass on your time. Again bidding you welcome, and hoping that Berkshire farming will receive a great impulse from your deliberations, I introduce to you Mr. Richard Goomand, president of the Berkshire Agricultural Society, who is a lawyer by profession, but a farmer from choice. He was not so fortunate as to be to the manor of Berkshire born, but when he came to the years of discretion, was wise enough to select for his home one of the most beautiful locations in the county, where among his books and his herds, he sets us an example not of "ease with dignity," but of skilful industry and busy research, and having a fluent tongue and limber pen, is ever ready to communicate the results of his investigations, and we feel much obliged to him for thus identifying himself with all the great interests of the county.

Richard Goodman, of Lenox.—The formal manner in which I have been introduced by my friend, Mr. Hyde, might lead you to expect a formal speech from me; but there is neither the time nor the opportunity for me to indulge in any extended remarks; and it is hardly worth while to reiterate the welcome which has been extended to you by Mr. Hyde. But as the representative of the Berkshire Agricultural Society, one of the oldest in the State, composed not only of farmers, but of manufacturers and others, who have an interest directly in farming, and also an interest in the prosperity of the county and the State, I welcome you here among the hills of Berkshire. It has been the custom of our southern friends, of more fervid climes, to welcome their guests "with bloody hands to hospitable graves." But we welcome you to-day with the white mantle of

peace—cold externally as chastity, but pure as virtue. But the coldness outside, I trust, will be more than compensated by the warmth of the hospitality which you will receive from the residents of this place. We welcome you, not only as ordinary guests, but because we want to see such men as you are, engaged in the vivifying industry which underlies all those on which the prosperity of our county depends. It is too old and too trite a saying to be reiterated, that upon agriculture depends the prosperity, and I might say, the virtues of the community.

We may inquire here, why is it that men like those who are our guests to-day should assemble in Berkshire, and at other times in Amherst and in other places in Massachusetts, for the purposes of disseminating agricultural knowledge? Why is it that similar conventions do not take place in relation to the other industries of life? It is because it is apparent to all, that without the fostering of a business so important as this, there might be danger of the whole fabric of the country being shaken.

But, gentlemen, we welcome you to-day among our mountains; and although we are far removed from "the Hub," although we are not gathered often in the meshes and nets that surround that centre of our eastern universe; yet you are come now to a people who are not at all barbaric. We have outlived all the greenness of our youth. We have got used to the improved machines of farming. We would welcome you at another season to land really flowing with milk and honey; to land where as good cattle are produced, where as good grain is raised, where as fine crops of corn, oats, and other cereals are produced as in any other part of the State. We are not in the condition of General Washington, who, having taken an inventory of his stock, exclaimed, "Here I am keeping 101 cows, and I have to buy my own butter." We have passed beyond the condition of the tenantry of Lord Derby, who, having been presented with steel ploughs, returned them at the end of the season, saying that they wanted to return to the old wooden ones, because they were satisfied that steel ploughs increased the crop of weeds! We have tried all the improved implements, and all the new processes of culture; and although, gentlemen, like all others engaged in this pursuit, our principal aim is to make our labor profitable, yet beyond that, we want to raise our agriculture, its products and its processes, to a level in many

other respects besides material prosperity, with the other avocations of the county.

Now, it is a remark current throughout the country, current especially throughout this part of the country, that the young men are forsaking agricultural pursuits, because they do not pay. Well, that is undoubtedly one reason why our young men are forsaking the culture of the soil and flying to the cities and towns; but there are other and as important reasons underlying that. Nearly a century ago, before the heat of the Gulf Stream was discovered, a winter voyage from England to New York or Boston was a hazardous thing, and the vessels engaged in foreign trade went during the winter months to Charleston and other southern ports, which were flourishing when the ports of New York and Boston were not in a prosperous condition. But after Dr. Franklin broached his theory of the Gulf Stream, and that became thoroughly known to the commercial community, the vessels coming from abroad went at once to the ports of New York and Boston, and the trade of the ports of the South decreased, while that of the ports of the North proportionately increased. It is the warmth of the gulf stream of intellect, trending towards our cities and towns, which draws our young men to the centres of population from the country, as well as the great desire to make money. The young men of this age are different from their fathers, in that they are reaching out for more education. They are not satisfied with plodding on behind a plough or a team, even when they can make money, when they see their compeers in the towns and cities rising above them in intellectual stature. That is what we want in Berkshire. We have as good a race of men, young and old, as is to be found elsewhere; our farmers are encouraged by their manufacturing friends, and by their compeers in other business; and all that we want now to elevate us to a position equal to that of others, is scientific education upon agricultural subjects. When I look around and see among the distinguished members of this Board, men who are devoting themselves to the purpose of elevating this profession, when I see men whose names are renowned, not only throughout this country, but throughout the world, I congratulate them upon the great work that they are doing, I congratulate the country upon the great good it is receiving from such work; and it is

because of those efforts, coming from such men, to elevate us as an agricultural community, and to make us what we should be and ought to be,—it is upon that ground especially that I welcome here to-day the distinguished men who compose the Board of Agriculture of Massachusetts.

SALT AND ITS USES IN AGRICULTURE.

BY PROF. CHARLES A. GOESSMANN, PH. D.

The discovery of common salt—in the commercial meaning of that article—belongs within the earliest stages of the human family. Wherever we find it mentioned upon the first pages of history it is spoken of as something known. Its presence in the waters of the ocean, of various lakes, and of certain springs, it appears, was not less recognized, than its occurrence as an exudation of the soil in particular localities.

Saline exudations so frequently found in the Orient, in common with the residues of accidental evaporations of some of those natural saline solutions, previously alluded to, have furnished, in all probability, its first supply. Its manufacture for commercial purposes by *artificial* heat applied to iron pans, similar to our present mode of working, has been credited to ancient Romans. Grecian and Roman writers, even centuries before the Christian era, begin to treat of it from a scientific point of view, although sometimes under a different name. Dioscorides, at the end of the first century, speaks of its peculiar cleavage, and describes already some of the differences between the salt resulting from the evaporation of sea-water and the rock salt. The famous alchemist Geber, who lived within the eighth century, it is stated, was engaged in experiments to refine the commercial common salt for chemical purposes.

The idea regarding the chemical constitution of the pure salt has changed quite naturally during the progress of the natural sciences, and of chemistry in particular. Our present view concerning its composition could scarcely have been advanced before 1810. The isolation of the metallic elements of the alkalies, and the proper recognition of the nature of the muriatic acid had to precede, before Sir Humphrey Davy could conceive the idea of proving by experiment, that the pure salt consisted of the two elements, sodium and chlorine. We observe at the close of the last and the beginning of the present century,

during a period of thirty-six years, some of the most profound thinkers, and, of the most skilful experimenters in the natural sciences of that age, engaged in presenting facts which bear upon the question here under discussion. Scheele recognized in 1774, for the first time, a peculiar gas by treating black oxide of manganese with muriatic acid, which subsequently became better understood by the name of chlorine. Sir Humphrey Davy succeeded, in 1807, in isolating, by means of a powerful electrical battery, the element sodium from caustic soda under proper circumstances. Gay Lussac and Thénard proved, in 1809, by very careful experiments, that the pure salt did not contain the element oxygen as one of its component parts; they advanced soon after, for the first time, the idea that the peculiar green gas which Scheele had obtained from the muriatic acid ought to be considered an element. Sir Humphrey Davy was the first chemist who, in 1810, adopted the proposition of these illustrious French savants; he named that element, on account of its (pale) green color in its gaseous state, chlorine, and produced finally the pure salt from its component parts by burning sodium in chlorine gas. Knowing once its elementary constitution, there remained but little to be done to learn the relative proportion of its component parts. The simple introduction of the balance, whilst repeating Davy's experiment, demonstrated the fact that twenty-three parts of sodium had combined with thirty-five and one-half parts of chlorine, producing fifty-eight and one-half parts of chloride of sodium, i. e., pure salt. *Natural solutions* of *chemically pure salt* are *not* known; its demand is supplied by saturating pure carbonate of soda with pure muriatic acid. *Natural crystals* of *pure salt* may be obtained by separating carefully individual crystals from well developed crystallinic masses of rock salt. I do not propose to treat here in detail of all the highly interesting and important physical and chemical properties of the chemically pure salt, for it would but amount to a more or less accurate copy of our text-books in physics and chemistry, and may be studied from them directly with much greater advantage. What I intend to attempt is to engage your attention for a discussion on "*common salt*" as known in *commerce* and *industry*, with particular reference to its application in the *various* operations of our agricultural industry. As these operations require a salt of different mechani-

cal conditions, and of a different chemical composition, which both requirements are governed by the peculiar mode of its manufacture, I find it advantageous, in the interest of our mutual understanding, to begin with a short sketch of our modes of manufacturing the different kinds of salt, and to conclude with its various uses.

I. Our Modes of Manufacture.

There are two kinds of salt in commerce; the "*coarse salt*," including the salt obtained from natural rock salt deposits and the salt made from brines and sea-water by means of solar heat, and the "common fine salt," or boiled salt, produced by artificial heat. The coarse qualities of salt are the results of a slow evaporation; the fine qualities that of a rapid evaporation.

ON COARSE SALT.

The coarse qualities are manufactured from sea-water and from brines. In France, Spain, Italy, Portugal, the West Indies, and along the shores of both the Atlantic and Pacific oceans on our continent nearly all the coarse salt made from sea-water is produced in basins along the seashores. These basins are either natural or artificial; several of them are, in either case, connected in such a manner as to admit of a systematical working of the saline solutions in their different stages of concentration. In Ohio, Virginia, Michigan, New York, and, of late, in Nebraska and Kansas, where the natural *brines* are used for the manufacture of coarse salt are preferred, wooden vats, protected by wooden covers—for the frequency of rain-showers throughout the more favorable portions of the year, and the low temperature at night during spring and fall, interfere very seriously with a successful evaporation, and thus economical manufacture, in open basins; wooden vats, with suitable movable covers, secure also a cleaner article. The rules adopted in the construction and systematic arrangements of these vats or basins are prescribed by the composition of the brines or saline solutions turned to account for manufacturing purposes. A short description of our most extensive solar salt works (Onondaga Co., N. Y.) may serve here as a general illustration. The brines of Onondaga are of a very good quality; they contain a considerable quantity of sulphate of lime (gypsum), a

very small quantity of chloride of calcium and chloride of magnesium, besides traces of chloride of potassium, bromide, and iodide of magnesium, and some carbonate of protoxide of iron, with free carbonic acid. The main object, under these circumstances, is to remove the entire amount of iron, more than one-half of the sulphate of lime, and as much as possible of the very objectionable deliquescent compounds—chloride of calcium and chloride of magnesium. To obtain these results, the following mode of working is pursued: the brine—being usually in its fresh state, colorless, and highly charged with carbonic acid—is filled into shallow vats and kept there until most of the carbonic acid has escaped and the protoxide has been fully oxidized and settled as a brown-red, insoluble precipitate of hydrated peroxide of iron; the saline liquid is then drawn off to a lower series of vats, where it is left for evaporation until crystals of salt appear; during this period the excess of sulphate of lime is separated. The brine being now completely saturated with salt is now called salt-pickle; it is ready for salt-making, and consequently removed from the separated impurities to another set of vats, where, by mere solar heat, the separation and accumulation of a coarsely crystallized salt takes place. The salt is, from time to time, gathered, whilst the remaining mother liquor will be discharged as soon as it reaches a concentration from 28°–30° Baume.* The less attention has been paid to the separation of the iron and of the excess of sulphate of lime (plaster or gypsum), the more concentrated the mother liquor from which the salt has been gathered, the less the salt-crystals themselves have been washed with new salt pickle before their removal into perforated tops for drainage, and the less chance they have enjoyed in rendering that last process efficient, the more inferior is the quality of the coarse salt produced. A good coarse or solar salt must be of a neutral reaction, hard, large-sized, white or colorless, and produce a clear solution.

ON COMMON FINE SALT.

The finer-grained qualities of salt are obtained by the direct or indirect application of *artificial* heat to iron kettles, iron

* Compare, for further details, my report "On the Manufacture of Solar Salt"; Syracuse, N. Y. 1864.

pans, or wooden vats; the more rapid the process of manufacture, the smaller are the crystals resulting from one and the same brine. In Europe, almost all the boiled salt is manufactured in a system of large pans of from four hundred to one thousand two hundred square-feet capacity; in most of our own salt-boiling establishments are used hemispherical cast-iron kettles of from one hundred and twenty to one hundred and forty gallons capacity. The kettle system is exclusively used at the Onondaga Works, N. Y.; in the Saginaw Valley, in Michigan, are employed, besides the kettles, large wooden vats heated by steam; in Ohio and South-western Virginia is, for weak brines, the so-called furnace-system in operation, which may be considered a combination of direct heat and steam heat, for evaporation. The steam heat being applied at the more advanced stages of evaporation produces a larger-sized salt. The best qualities of Virginia brines, for instance, at Saltville, in North-western Virginia, are very successfully worked in cast-iron kettles. Inferior brines, particularly those which contain a larger proportion of the chlorides of calcium and magnesium, as a general rule, are best worked by a slow process of evaporation, for the salt crystals are in that case more perfectly developed, and the inferior mother liquors consequently best excluded.

The process of salt-making is quite obviously an operation for the separation and thus purification of the chloride of sodium (salt) from its accompanying foreign admixtures; the general rules, which apply to the proper management of a successful crystallization, find their application here. Brines which contain a considerable percentage of the sulphate of lime, or of soda, or of magnesia, or several of them, produce always smaller crystals than those which contain less or none. The boiled salt of the Onondaga brines is, on that account, always smaller and more compact than that manufactured from the brines of Michigan, Ohio and Western Virginia. The European system of manufacturing common fine salt in a system of large iron pans,—a fore-heater and a grainer,—our own modes of making fine salt in wooden vats by means of steam, the furnace system of Ohio, and the Chapin system of Saginaw differ in one essential feature from the kettle system; they aim at the removal of certain impurities in a separate vessel and the making of the salt in another one,

whilst in the kettle system the separation and removal of the impurities take place in one common vessel with the making of the salt. The manufacture of boiled salt in hemispherical cast-iron kettles is peculiar to our country; its success, so far as the quality of our home-made salt is concerned, is more due to our superior qualities of brines, and the skill of the workmen in charge of its manufacture, than to the fact that the mode of making our boiled salt is based, in that particular case, on the safest principle. From the fact that twenty to thirty kettles are placed in rows over one common fire and along one common flue, it will be apparent that the separation of salt must take place within the various kettles at a different rate and under otherwise different circumstances. The salt obtained from the various kettles differs consequently more or less in its mechanical condition and its composition; the salt obtained from the front kettle is more compact, of a small grain, hard and heavy, whilst the salt made in the back kettles is of a looser aggregation, consequently bulky and light. To secure a desirable uniformity for commercial purposes, the salt is always mixed in the storehouse before packing. The chemical composition of the boiled salt is, to a large degree, controlled by the same circumstances which have been pointed out in the case of the composition of the coarse qualities of salt. As not two brines are of an entire corresponding composition, there can be no two samples of salt, made from two different brines, alike. All our commercial varieties of salt differ, therefore, somewhat on account of the mode pursued in their manufacture and the nature of the saline solutions turned to account for their production. A good "common fine salt" ought to be of a neutral reaction, of a clear white color, of a pure, agreeable saline taste, and of a gritty feeling between the fingers; it ought to dissolve without any particular residue in five to six parts of water, and its moisture ought not to exceed from four to five per cent.

Our present demand of salt, which is still almost exclusively confined to its uses for domestic purposes and in agricultural industry, exceeds our production—a fact which is not so much due to a real want of suitable natural home resources as to their disadvantageous local distribution. Whilst the Central, Middle and South-western States are daily increasing their local

natural salt resources, the Eastern States seem to be destined to draw their supply of salt from New York, the West Indies and England. What influence the extensive rock-salt deposits of Petite Anse and Neyba, of St. Domingo, and the excellent brines of Goderich, C. W., will have in the future on our daily increasing demand may be well conjectured. Of the thirty-two to thirty-four million bushels of salt which we at present most likely annually consume, only from fifteen to sixteen millions of bushels are of home production. We use the largest amount of salt in our meat-packing and dairy business,—less for the promotion of animal life, and the least amount for the promotion of vegetable growth,—at least as far as in the latter case a *direct* application is concerned. The highly desirable consumption of salt, on a becoming scale, in the industrial arts, is still depending on a future wise legislation; the absence of an alkali trade and the varied allied industrial branches are not less to be deplored by the farming community than by others; for, to say the least, it deprives agriculture of many cheap and valuable sources of by-products and refuse materials of an excellent fertilizing quality.

II. On the Uses of Salt in Agriculture.

ON MEAT-PACKING.

The element chlorine, one of the constituent elements of salt, imparts its preserving quality more or less to most of its combinations with the metallic elements. Some of these compounds are quite successfully applied for the preservation of anatomical objects, and of objects for collections in natural history in general; most of them are, of course, from an economical and a sanitary point of view, objectionable for any general application in domestic industry. The meat-packer does not aim at a mere preservation of his beef and pork; his main object will always be to secure the keeping of his meat in its most palatable condition, and as much as possible of its natural color. Chloride of sodium, or what means here about the same, a good commercial salt, answers both ends satisfactorily, if properly applied. It does not necessarily change the color of the meat, nor does it affect its tenderness beyond reasonable limits; it is also a good antiseptic, for it prevents, if present in a sufficient quantity, the development of organism of a lower order, which in their

growth, as a natural consequence, will hasten the disintegration of the meat mass, and thus its final putrefaction.

Practice recommends the use of the coarse and hard qualities of salt for meat-packing, for the following reasons: they dissolve gradually, and contract the meat by degrees to a desirable compactness; they keep the salt pickle within a certain moderate concentration; they cannot enter mechanically into the meat, and thus overcharge it, and may therefore be applied in a sufficient excess, so as to compensate for the losses of pickle by leakage, &c., without endangering the tenderness and the flavor too prematurely. The *common fine salt* answers for a short period of keeping very well, and is consequently used in the packing of meat for immediate family consumption. Fifty to fifty-six pounds of coarse salt are usually taken for the salting down of one barrel of meat; the bottom and the top of the barrel are always carefully covered with a layer of coarse salt. The coarse qualities of salt which are used in our country are either manufactured from brines or from sea-water. The purer the salt, the nicer is the flavor of the meat. A salt which contains large quanties of foreign saline admixtures, particularly of chloride of calcium and of chloride of magnesium, imparts a pungent and disagreeable taste, and injures also the color of the meat; for these saline compounds have themselves, both an unpleasant taste, and being at the same time in a higher degree hycroscopic, they cause a more copious discharge of juice from meat, which renders the latter of a paler color, and of a harder texture; the color of the packed meat is frequently improved by an addition of nitre (nitrate of potassa), which in itself, if practised on a small scale, is a quite harmless proceeding. We are using mainly the coarse salt made from our own brines and from sea-water, besides the English coarse fine salt, and the Turk's Island salt, including that from some other localities in the West Indies. In some countries the rock salt is used for meat-packing; Texas meat-packers are at present engaged to give a trial to the superior rock salt of Petite Anse, La. A good rock salt is well fitted for that purpose, yet, on account of its great hardness, it has to be broken up in smaller pieces than common solar salt. The United States government requires that the beef and the pork for army and navy use shall be packed with Turk's Island or Onondaga coarse salt. At the New York works

4

the finer salt crystals are removed by means of a screen from the coarser portion, which renders the latter still more acceptable to the meat-packer. The commercial brand of a coarse salt is by no means a sufficient title, as a general rule, for its particular fitness, for no kind of salt in our markets is so independent in its good composition, from the nature of the saline solution or brine, which has been turned to account for its manufacture, as the coarse qualities. How much the mode of manufacture, and its careful working makes itself felt in that direction, is best illustrated by the fact that the oceanic water, which does not show any particular difference in its chemical composition, and which at the same time must be considered a very inferior saline solution or brine, as far as its composition is concerned, furnishes us with some of the best and also some of the most inferior articles of coarse salt in our markets.

To convey some idea about the character of the various brands of coarse salt, which may come under our notice, I give here some analytical results of my own, with but one exception—the *Turk's Island salt.*

For the sake of a due appreciation of these figures, I will add, that the sulphate of lime, within proper limits, must be considered as being the least objectionable foreign admixture of salt, and that the percentage of water (as given) may be looked upon as being here merely accidental; it ought, for that reason, not to enter into any calculation of comparative merits.

	Rock salt of Petite Anse, La.	Onondaga, N. Y., solar salt.	Hooking Valley, Ohio, solar salt.	Saginaw Valley, Mich., solar salt.
Chloride of sodium, ...	98 882	96.004	97 512	95 831
Sulphate of lime, ...	0 782	1.315	0.000	0 316
Chloride of calcium, ...	0 004	0.092	0 234	0 356
Chloride of magnesium, ...	0.003	0.089	0.089	0.140
Moisture, ...	0.330	2.500	2.130	3.344

	Rock salt of Neyba, St. Domingo, W. I.	Turk's Island, W. I., coarse salt, (solar.)	Solar salt of Kansas.	Solar salt, Nebraska, Lincoln Co.
Chloride of sodium, ...	98.33	96.76	93 06	98.13
Chloride of magnesium, ...	0 09	0.14	0.24	0.08
Sulphate of lime, ...	1 48	1.56	1.22	0.25
Sulphate of soda, ...	0.07	0.64	0 35	0.39
Sulphate of magnesia, ...	0.07	0.00	0.18	0.00
Moisture, ...	0.30	0.90	4.95	1.20

ON DAIRY SALT.

The dairy business, a most important branch of our agricultural industry, has attained of late such commanding proportions, that the amount of salt required in its operations bids fair to be counted henceforth by millions of bushels. The peculiar nature of our dairy products calls for the best qualities of salt in our markets. A good dairy salt ought to be of a neutral reaction and of a pure saline taste—free from pungent after-taste ; it ought to be of a properly reduced granulated size, free from any offensive odor, without any stain in color, and, what is of not less importance, free from colored specks. The better qualities of the English " common fine salt," for instance, Ashton's brand, etc., were not many years ago almost exclusively used by our dairymen. This practice, it appears, was not a little favored by the fact that the exporters of provisions in our seaport towns dealt also largely in foreign salt. Whatever we may think at present about the past, we have to recognize the fact, that the home manufacture of superior articles of salt has received of later years considerable attention ; our salt manufacturers have taken advice, and numerous farmers' societies and experienced dairymen assure us, that there is at present less cause to believe in the assertion of bygone days, that nothing but Ashton's, or English double refined salt, will make a good butter. As a common fine or boiled salt is in every instance the result of a more rapid evaporation, and thus most liable to be affected in its desirable good composition by the retention of impure mother liquors, washing processes have been devised, by which our fine salt, designed for dairy purposes, is freed from its obnoxious features. It was quite apparent that the presence

of the chlorides of calcium and magnesium, and the sulphates of soda and magnesia, which all brines in part at least contain, must injure the sweet taste of the butter in particular, if present beyond mere traces; to exclude them either entirely, or to reduce them to a harmless fraction, has been the object of our dairy salt-men, at least in some centres of that branch of industry—New York Onondaga works, for instance.

A salt of a decided alkaline reaction, caused by a too liberal use of slacked lime for the exclusion of iron—in the interest of a fair white color—or those qualities which contain larger quantities of the carbonates of lime and magnesia, are very objectionable. They cannot act otherwise but bring on a decomposition of some of the neutral fatty compounds, of which the butter is mainly composed, and which a good cheese to a varying proportion contains. This decomposition itself becomes manifest by a so-called rancid taste and an objectionable odor, and is due to the liberation of some of the volatile fatty acids, as butyric acid, etc. The presence of slacked lime in substance in any kind of salt, be it ever so small, renders that salt not only unfit for dairy use, but also for meat-packing. Our home-made dairy salt is manufactured from the coarse (or solar) and from the common fine salt; if made from the former kind, it must be *ground finer*, for both ought to be in such a state of division as to be readily dissolved when worked into the butter or the curd; both kinds ought to be used by *weights*, and not by *measures*. The English, Ashton's brand, is somewhat more bulky than both of our home products, and that portion of our home product which has been obtained from boiled salt is again lighter than that produced from solar salt; in composition there need to be scarcely any difference if made with equal care. The quantity of dairy salt which ought to be used in salting butter and cheese depends somewhat on the amount of moisture retained by either of them when ready for salting; to have a *fully saturated solution of salt left* is *the real object*. Well endorsed quantities are one ounce of the best dairy salt to every one pound of butter, and one pound of it for every one hundred pounds of curd.

Whilst I have thus far spoken of the liability of spoiling an otherwise well prepared butter, or a good curd mass by adding an inferior salt, etc., I need scarcely to add, that I do not entertain in the slightest degree the opinion, that the *best* salt will ulti-

mately save an otherwise carelessly made butter. There remains but little doubt in my mind, taking the peculiar nature of our dairy products into consideration, and that of the butter in particular, but that in many instances, where the salt has been blamed for a prematurely rancid butter, or a badly flavored cheese, it would have been sometimes, at least, a safer presumption to suspect some other oversight in their manufacture. Aside from the well recognized good influence of a good pasture, a good water, and a proper temperature whilst manufacturing on the general character of our dairy produce, here under discussion, it is manifest, that the sweetness of odor or taste, of a good butter for instance, does depend to a large extent, on an unimpaired neutral state of the various fatty compounds, of which the butter consists. Whatever inaugurates changes in that direction ought to be carefully excluded ; an inferior salt, as previously described, is one of the causes, which hastens a change for the worse ; an insufficient amount of a good salt another ; a lengthy exposure to the atmospheric air before removing effectually most of the caseine (cheese-stuff), and of the milk-sugar, another ; and too high temperature whilst manufacturing, (best 52° to 54° F.) and too much stirring and thus spongy state of the new made butter are other causes. An unnecessary exposure even to the air, after a careful management of the entire operation, must be counted among the various principal causes, which practice and science have thus far recognized as affecting most decidedly the preservation of the butter. We resort to a salting of our butter, to aid in the free discharge of the buttermilk, and to contract it ; to shorten thus the process of washing, and to saturate the entire fat mass with a saturated solution of a good salt, which shall exclude the air, and at the same time act as an antiseptic towards the small quantities of caseine (or cheese-stuff), and of milk-sugar, which a desirable limited washing of the butter after its separation from the buttermilk will leave behind. Pure butter is the most complicated natural fat mass on record : it consists of not less than eight fatty acids in combination with a substance known in its isolated state by the name of oil-sweet or glycerine. Four of these acids in their isolated state are solids ; four of them are liquids ; these latter acids are remarkable for their unpleasant odor and taste ; whilst in combination with that peculiar compound, the

oil-sweet, that strong odor is not noticeable, but as soon as that combination by some cause or another is disturbed, their objectionable odor and taste become manifest, and we say the butter is rancid. Practice seems to endorse in the interest of the making and preserving of a good butter, the following rules: have your apparatus for butter-making well cleaned; do not churn at a higher temperature than from 50 to 56° F.; keep off all offensive odors, for fats as a general rule absorb them very readily; carry the entire process on with speed, and shorten thus the injurious access of air under very disadvantageous circumstances; wash the separated butter under little agitation with a saturated solution of best dairy salt, and repeat this last treatment but a few times. Too much washing injures the quality of the butter as far as the nicety of its flavor is concerned; too little washing leaves too much milk-sugar, and particularly caseine (or cheese-stuff) behind. This caseine is, in the language of chemists, a nitrogenous substance, and is most remarkable on account, not only of its disposition to break up into very disagreeably smelling and tasting substances, but also to have the property to impart its own instability upon other more stable compounds, as, for instance, the neutral fats of the butter. Its effect on the butter is a mere question of degree, which salt under the most favorable circumstances, will only prevent for a limited time. The larger the amount of caseine left, the sooner will the butter be changed, a result which a perfect tight-packing, and thus most efficient exclusion of the air can only somewhat delay. The following analysis may give some idea about various kinds of salt,—common, fine and dairy salt, which we are consuming for family use, and in the dairy business.

Common Fine and Boiled Salt.

	Of Onondaga, N. Y.	Portsmouth, Mich.	Mason City, Ohio.
Sulphate of lime,	1.355	0.805	–
Chloride of calcium,	0.155	0.974	0.614
Chloride of magnesium,	0.136	0.781	0.041
Moisture,	3.000	6.752	3.470
Chloride of sodium,	95.353	90.682	95.789

Dairy and Table Salt.

	English—Ashton's salt.	Onondaga dairy salt.
Sulphate of lime,	1.4300	1.2630
Sulphate of magnesia,	0.0480	0.0225
Sulphate of soda,	–	0.0260
Chloride of magnesium,	0.0600	0.0370
Insoluble matter,	0.0500	0.1200
Moisture,	0.7600	0.7000
Chloride of sodium,	97.6520	97.8315

ON SALT AS A PROMOTER OF ANIMAL LIFE.

Natural instinct, no doubt, has induced man and beast to make use of common salt. Its intrinsic value was always well recognized; the oldest writings, sacred and profane, refer to it by using its name frequently in a figurative sense; it had entered as an ingredient, with an emblematical meaning, in the Jewish dispensation; heathenish authors spoke in praise of it; Pythagoras calls it a substance dear to the gods, Homer calls it divine, Plutarch speaks of it as a symbol of the soul. The Arabs of the present day, we are told, use it as an emblem of hospitality, and the Abyssinians carry pieces of salt with them to offer it for tasting to those whom they wish to meet as friends. We ourselves consider it an important spice to render our food palatable, and believe its direct use, within proper limits, almost indispensable for the continuation of the normal function of our organs of digestion and secretion. Almost all wild and tamed herbivorous animals, without exception, hunt by natural instinct for sources of salt to supply their craving. The opinion that the direct use of salt as an addition to our food was not necessary for the support of animal life—for most articles of our food did contain already a sufficient amount of it to answer for all practical purposes—may be true under particular, exceptional circumstances, and as far as a mere maintenance of life is concerned; yet as soon as the promotion of a vigorous animal life in general comes into consideration it has lost its force as an argument, particularly as far as our domestic herbivorous animals, as horses, cattle, sheep, and the like are concerned. We concede, also, as far as man is concerned, that

our practice of adding salt to our food must be looked upon as being, in part at least, a taste acquired by cultivation.

Carefully conducted practical experiments by some of our foremost agricultural chemists have settled that question; their experiments have reduced to figures what mere experience in more favored localities in a general way seemed to indicate. Boussingault proved by cows, that those which had been fed with an addition of salt to their food did not yield more milk, or contained more fat, or had increased in weight of flesh; yet they looked more healthy and more vigorous; in fact, their whole exterior had been highly improved as compared with animals which had been fed with the same food without an addition of salt. Liebig came to the same result; he found in the case of two oxen, which were to be fattened in the stall, and of which one received its food mixed with an additional dose of salt, while the other one did not receive any, that the latter one soon looked bristly, dull, inactive and sickly, while the first one, which had received salt as an addition to his food remained smoothly skinned, lively and vigorous. Pasture-feeding on a good grass crop, with its accompanying limited physical exercise in the open air, has been always considered the most normal food of our domesticated herbiverous animals as far as an aromatic, tender meat, with a liberal amount of well distributed fat, is concerned. The well recognized *superior* quality of meat from the cattle and sheep raised upon the marsh meadows along the seashores of Northern Germany, Holland, Belgium, England and elsewhere, has been ascribed to a large degree to the fact that their food—the marsh grasses—is frequently salted by the spray of the oceanic waters. Most of those who are at present engaged—remote from access of saline solution—with the raising and fattening of cattle and sheep are taking lessons from the previous observations, and are using freely salt, apparently with decided advantage; they presume that a proper daily dose of salt does aid in a well-regulated and thus economical digestion; for it seems to favor a speedy solution and assimilation of the food, and at the same time creates an increased desire for water, which being promptly supplied causes an increased secretion of urine and perspiration. As nature has chosen these two ways, among others, to remove from the animal system those substances, which either have served

their purpose, or are worthless whilst in an excess present, they conclude quite properly that an increased secretion of urine and perspiration may dispose of these obnoxious substances more freely, and thereby render a somewhat abnormal high stall feeding and a want of desirable exercise less serious. The results of practical investigation, it appears, may be summed up in the following statement: salt does not increase directly the live weight, yet it favors an economical digestion and assimilation of the requisite normal amount of food, and it allows us, if desirable, to feed our stock high without incurring a particular corresponding risk; it enables us thus to shorten the time for getting our live stock up to a desirable market value, and assists us, under certain circumstances, to dispose advantageously of a larger proportion of other farm productions, as grain, hay, etc., in the form of live weight.

Having thus far considered merely what direct experimental investigation seems to teach, it may not be without some interest to see what results chemical and physiological inquiries here have ascertained. Numerous analyses of animal substances have established the fact, that the soda compounds and chloride of sodium (salt) in particular, represent in every instance the main portion of the *soluble* inorganic substances of the ashes of the entire mass of any animal of the order of mammalia. It has been proved that our own system in its normal condition does contain a certain amount of salt, and that every class of animals contains it in a particular proportion, varying only within certain limits. It has also been ascertained that salt forms an important part of the soluble saline inorganic compounds of various secretions, as *perspiration*, *mucus* and *urine*, and that the kidneys in particular are the organs which dispose of its excess consumed. As salt (chloride of sodium) furnishes by far the largest portion of the soda compounds, which the animals of a higher order consume, it has been presumed that the main portion of the soda compounds found in the animal system has been directly derived from the chloride of sodium consumed. This assumption implies, as a natural consequence, that chloride of sodium must necessarily act in two directions, in its *unchanged state* and in *its products of decomposition;* the presence of free hydro-chloric acid (muriatic acid) in our stomachs suggests this view. Knowing that it renders, under

certain conditions, various nitrogenous matters, as the albumin and the caseine soluble, and that it retards the coagulation of the fibrine, it has been presumed, apparently with much propriety, that its constant association with the so-called (proteine) nitrogenous substances within the animal body must have something to do with the transformation of those peculiar compounds, although we do not yet fully understand the manner in which it is accomplished.

A few analytical results of reliable authors (C. G. Lehmann, Hoffman and others) may serve as an illustration of some previous statements.

Human Blood.

Coagulum or Clot.	Fibrine,	0.30	13.0
	Corpuscles,	12.70	
Serum =	Water,	79.00	87.0
	Albumin,	7.00	
	Fatty Matters,	0.06	
	Salts,	0.94	
		100.00	

Blood of Vertebræ.

1,000 parts, leave—	
Dry substance,	220.0
Which contains—	
Nitrogen,	37.0
Mineral substance,	10.0
Containing—	
Potassa,	0.5
Lime and Magnesia,	0.2
Sulphuric Acid,	0.5
Phosphoric Acid,	0.5
Chloride of Sodium, Soda, Sesquioxide of Iron, Silica,	8.3

Analysis of the Ashes of the Serum.

Chloride of Sodium,	61.087
Chloride of Potassium	4.054
Carbonate of Soda,	28.880
β Phosphate of Soda,	3.195
Sulphate of Potassa,	2.784
	100.000

Flesh of the Vertebræ.

1,000 parts, leave—	
Dry substance,	250.0
Which contains—	
Nitrogen,	40.0
Mineral substance,	15.0
Consisting of—	
Potassa,	5.0
Phosphoric Acid,	6.5
Lime and Magnesia,	0.5
Sulphuric Acid,	0.5
Chloride of Sodium, Soda, Sesquioxide of Iron, Silica,	2.5

We believe, as I previously mentioned, that the chloride of sodium is partly decomposed in the animal system, although we do not yet know how it is brought about; for our stomach in its normal condition contains always some free muriatic acid. The serum of the blood of our herbivorous animals resembles closely in its composition, as far as its mineral constitutents are concerned, that of the human blood; it contains at least three parts of soda to one part of potassa, although these animals do live on a food in which the potassa largely predominates; the bile contains almost exclusively soda compounds, whilst the juice of the flesh of herbivorous, as well as the carnivorous, animals, contains almost exclusively chloride of potassium. It is under these circumstances, most likely, that the potassa of the vegetable food continually decomposes the chloride of sodium (or salt) by forming chloride of potassium, which is subsequently constantly and copiously secreted, particularly in the urine, whilst the sodium combines with the phosphoric acid and the various peculiar organic acids, which were either previously combined with potassa, etc., or were formed in the course of the assimilation of the food. Whatever we may think about the details of the mode by which these changes may be accomplished, we have to acknowledge that the observations stated are pointing in that direction. One important feature of a more general character must have become prominent in the discussion of my subject, namely, the decided preference of the *animal economy* for soda compounds; for we notice, that although our domesticated herbivorous animals do live on a food in which potassa compounds largely predominate, they accumulate soda compounds, and reject to a considerable degree the

potassa. It is rendered thus manifest that soda and potassa, although resembling each other quite closely as far as their general chemical properties are concerned, must exert a quite different influence on the animal system, and cannot substitute each other beyond narrow limits without affecting its normal functions.

ON SALT AS A PROMOTER OF VEGETABLE GROWTH.

Mere practical experience, we cannot deny, has rendered quite frequently contradictory and conflicting answers regarding the question ; is a DIRECT application of salt for fertilizing purposes really advantageous or not, and if so, under what circumstances have been obtained good and valuable results? Considering the situation of those at an earlier stage of inquiry, who have endeavored to enlighten us on that question, we find it could not be otherwise ; for it is with salt, as with all other artificial fertilizers: to apply them, and to draw correct conclusions from the results obtained, are two quite different and separate operations, and not necessarily connected. As long as the peculiar *wants* of the *soil* and its *physical conditions*, as well as the *nature* and the *composition* of the *fertilizers*, have not been *carefully ascertained*, it would have been better to suspend our decision than to proclaim hasty conclusions; without being able to trace reasonably the connection between cause and effect our decisions cannot claim to be final. To experiment, for instance, *with salt* upon a piece of land before convincing ourselves about its deficiency in soda compounds, would be as much out of place as to consider salt and the refuse of salt-works necessarily identical substances. An oversight in both directions has no doubt been productive of many conflicting statements. I propose to enumerate here, first, some of the best supported experimental results of practical investigations of an early date, and shall subsequently attempt to reconcile them with conclusions, etc., of a later date.

The luxuriant grass crops upon marsh meadows along the seashores have been pointed out frequently as a proof of the advantageous influence of saline solutions on the growth of grasses. Agriculturists of note have recommended the direct use of small quantities of salt from time to time upon a warm and dry soil, and asserted, as far as the experiments in England

are concerned, that in most cases of experiments with salt, where negative* results have been obtained, the soil might be reasonably suspected as having contained already a sufficient amount of soda compounds and of chloride of sodium to answer all practical purposes. All these recommendations of a *direct* use of salt as an efficient fertilizer have one important feature in common, namely, they caution to use but little at a time, to apply it in a finely divided state, and to use it only at intervals of years. As directly injurious effects on the other hand are pointed out: its serious influence, for instance, on the tobacco leaf and on the juice of the beet-root. It is claimed (*Nesslar*) that its presence interferes with a ready combustion of the former, favoring its charring, an effect in which it acts quite reverse to potassa compounds; in the case of the juice of beet-roots it has been proved (*Grouven*) that it increases, in a considerable degree, its percentage of soluble saline compounds, and thus reduces the value of the beet juice for the manufacture of sugar. The fact that larger quantities of salt are death to our common flora, and that it merely supports a vegetation of its own, becomes at once manifest to those who glance at the vegetation in the immediate vicinity of salt-springs and marine inlets. In sight of these statements we are obliged to sum up our case thus far in the following verdict: the *direct* use of *salt* alone, as an artificial fertilizer, requires great precaution *in the manner of its application*, and *in the selection of crops*, for *its beneficial effects* seem to be due in a great measure at least *to its indirect action.*

More detailed and well planned inquiries of a later date concerning the causes of the peculiar workings of the salt tend to confirm the previous verdict; they gave us besides, some valuable information in other directions. Our whole system of manuring our farm lands is based mainly upon the principle to restore to the soil those substances which we carry off by our crops in larger proportion than nature can supply. The importance of an artificial fertilizer is therefore due to its rate of consumption. Numerous analyses of soil have taught us that soda and potassa compounds are almost invariably accompanying each other, and are in most cases more or less constant admixtures of the soil. Thousands of analyses have demon-

* These localities were along the seashore, and within access of oceanic spray, etc.

strated the fact that all plants, with the exception of a comparatively limited number of species of plants growing along the seashores or in the vicinity of saline springs, contain much smaller quantities of soda than potassa compounds, and, as a natural process of the disintegration of rocks and soil does render, in all probability, soda as well as potassa accessible as plant-food, there is far less reason, as a general rule, to expect as soon an exhaustion of the soil on soda compounds as on potassa.

These few considerations explain to us the position, which soda compounds—and chloride of sodium is not only its cheapest, but also, for obvious reasons, its most diffused form in our lands under cultivation—do occupy in the vegetable economy; they have to be considered of secondary importance as plant-food for the promotion of vegetable life *as long as a relative percentage of the various mineral substances in the ashes of plants may be taken as a measurement of their importance in* the direct support of the promotion of their growth. Careful experiments by E. Wolf have left no doubt that salt is liable to injure the growth of plants; he experimented with seeds of two of the most important natural groups of cultivated plants—the graminæ and leguminosæ—(barley and vetch); he found that 0.52 percentage of salt in a soil would considerably retard vegetation, and that 1.02 percentage would even kill the germ; the only saline substance among our artificial fertilizers, which somewhat excelled the salt (chloride of sodium), was the salmiak (chloride of ammonium); finding that the nitrates, phosphates and sulphates of soda and ammonia act far less injuriously, we conclude, quite properly, that the chlorine—one of the constituent elements of salt (and salmiak)—must be one of the causes of a frequently-reported injurious effect in consequence of the direct use of salt for fertilizing purposes. The injurious effects, of late recognized in many instances, in Germany and elsewhere, where the celebrated Stassfurth dungsalt has been extensively used, have caused their present transformation from combinations of chlorine into combinations with sulphuric acid or into sulphates. The belief in the general efficiency of salt as a fertilizer has been apparently so much shaken in Germany that numerous factories at Stassfurth, etc., are now

engaged to manufacture a so-called concentrated dungsalt by a process which aims at, if not the entire, at least, the partial exclusion of the chloride of sodium (salt) from its saline constituents. The fact that the price of the Stassfurth dungsalt is controlled at present by its percentage of chloride of potassium, and not by that of the salt (the chloride of sodium), illustrates almost as well as anything else the drift of opinion.*

I have stated already that many reports on experiments with salt speak of it as refuse-salt, or salt-refuse, or refuse of salt works, designations, which apply to substances of a quite different composition and value. These substances are obviously recommended because a good salt is too expensive to be economical. Salt-refuse, coming from our home salt works, may be obtained from three different sources; it may be an incidental result of the manufacture of salt—a salt of an inferior color; it may be the ground-up incrustations of the boiling kettles, or the dried-up mother liquors. The first kind is most properly called refuse-salt; it consists mainly of salt (80–90 per cent.), with varying quantities of sesquioxide of iron, caustic, carbonate and sulphate of lime; it is frequently used for salting hay, and entirely unfit for other domestic uses. The *second article*, from our salt-boiling establishments east of the Mississippi River, consists of salt and gypsum (plaster, sulphate of lime), varying from 10–90 per cent. of the former and 90–10 per cent. of the latter; from the brines of Kansas and Nebraska this article would consist mainly of sulphate of soda, sulphate of magnesia and sulphate of lime, which imparts a much higher value to it. The third article, the dried-up mother liquors, would contain large quantities of the chlorides of calcium and magnesium, besides chloride of sodium and smaller percentages of chloride

* *Analysis of two Specimens of Stassfurth Dungsalt.*

	I.	II.
Chloride of sodium,	84	56
Chloride of potassium,	3	18
Sulphate of potassa,	2	1
Sulphate of soda,	–	7
Sulphate of lime,	1	5
Carbonate of lime,	–	2
Coal and other organic substances,	7	2
Water,	3	9

of potassium; the presence of potassa and magnesia enhances its value. Nobody acquainted with these facts would credit the good results obtained by their indiscriminate use to the salt alone. We find, thus, that the leading agriculturists of Europe, after years of practical and scientific investigation, have arrived at the conclusion that the benefits to be derived from a *direct use* of salt are quite exceptional, on account of its general, although limited, diffusion throughout our cultivated soils, and its slight demand on the part of our farm plants in general; and that its exceptional good effects, wherever noticed must be due to its indirect influences on the soil and its inorganic plant-food. Some of these indirect influences are: it aids in the solution of phosphate of lime, in the transformation of gypsum, etc.; it increases the water-absorbing properties of soil—hence its effect upon dry and warm soil—and assists thus, apparently, by both its chemical and physical action, in a more speedy disintegration of the soil. The practice of adding saline mother liquor to liquid barn manure, or salt to dry barn manure, or to compost manure, or to guano, or to superphosphates, and to all such other artificial fertilizers, which are affecting its composition, derives its general recognition as being frequently a good one, no doubt, from such exceptional influences as previously enumerated.

In reviewing my previous statements, I am inclined to indorse the advice I read off: *the safest and cheapest way of supplying salt to your farm lands, if at all desirable, is to feed it to your live stock, for natural channels of distribution are always the best.*

MINERAL MANURES.

THE PRESIDENT. The subject for discussion is Mineral Manures. All our fertilizers are divided into two great classes —organic and inorganic. The organic manures come from the air, that great reservoir provided by nature. The inorganic manures, which are found in the ashes of plants, must be derived from the soil, and they are far more important than we generally consider them. These inorganic manures are very apt to be exhausted from the soil, by being carried off in the crops. I think all our old farms are suffering greatly for the

want of inorganic and mineral manures, and I hope that all the gentlemen present, not only of the Board, but the practical agriculturists in the community, will give us their views freely upon this important subject. The discussion is open for every one. I see Mr. Foote, of Williamstown among the audience. I remember that when I was in college, he used to go round and gather up all the ashes he could find for his farm, and I hope he will give us the results of his experience.

ASAHEL FOOTE. I did not expect to be called on, in the presence of these representatives of science, to lead in a discussion of this sort. I am very happy to see it announced in one of our leading agricultural journals, that at this and subsequent sessions, an abundant opportunity will be afforded to farmers to ask questions and elicit information upon the various topics that are discussed. This is just as it should be. What we farmers want, what we particularly need, is information—light. I hope it is just what we feel that we want, for if we want it we shall ask for it; and I know of no surer method of obtaining light, whether from the heavens above or the earth beneath, than by asking for it. For the lighting of our dwellings in these latter days, I know that we are indebted not wholly nor chiefly to the flowing oil well, but mainly to the simple process of *pumping*, by which the illuminating fluid is brought to the surface from its hidden depths below; and for our mental illumination, we Yankees are indebted not altogether to the learned essay or to the flowing lecture, however instructive, but largely to that inquisitive faculty, that *pumping power*, if I may so call it, by which our Yankee nation is characterized. I hope that during this and the succeeding sessions of the Board there will not be wanting numbers of live Yankees who shall justify their reputation in this regard by giving full scope to this, their peculiar gift; especially as I cannot help "guessing" that these embodiments of sciences, commissioned by the powers that be, and sent out from the "hub" to all parts of the Commonwealth, for the very purpose of enlightening our ignorance out here on the rim, are just the wells we need to pump for our enlightenment.

You have been pleased to mention some of my operations in farming, particularly with reference to the use of ashes as a

manure. I have had some experience in that line for the last thirty years. I began about thirty years ago by using leached ashes, delivered on my premises at four cents a bushel, for which I am now glad to pay eight cents a bushel and haul them four miles. I have great faith in the virtue of ashes, whether live ashes or leached, for agricultural purposes, on gravelly or sandy soil. I have never known them, in my experience, to fail. I have used them in various ways—sometimes by composting them with muck and barnyard manure, sometimes by mixing them with plaster. Of late years for my corn crop, I have more commonly pursued the latter method, of mixing perhaps two bushels of plaster with three of ashes. I find that with this simple dressing, dropped in the hill when planting corn, I double my crop on ordinary gravelly soils. I put a moderate handful in a hill, taking care that the corn is not dropped upon the ashes. Live ashes might be used in the same way, but they must be used, of course, more cautiously. In the case of live ashes, the effect is more immediate, I doubt not, on the crops, owing to the presence of those properties which, in the case of leached ashes, are drained out in the processes of leaching; but the effect of the leached ashes which we get from the soap-boiler is far more durable. I have seen an instance where leached ashes were applied liberally twenty-five years before and the effect was still visible.

Professor CHADBOURNE. I should be glad to say a few words upon the subject of mineral manures. My friend Foote has referred to certain wells, which he has intimated have come up here from the "hub," to be pumped by those who live upon the rim of the universe. I live on the rim. I have not only lived in Berkshire, and, therefore, claim to have been upon the rim, but I live now on the outer rim. I have come from a place where we call this "the hub." I supposed my friend referred to the scientific men who have made the study of plant-life a specialty, and, therefore, are supposed to know exactly what plants need in order that they may grow well. I do not believe there is a chemist or naturalist in the world who knows so well what a plant needs for its growth, as the plant does itself. I am fully satisfied that long before chemists were invented, or naturalists known, the plants understood that thing. The best that scien-

tific men have been able to do is simply to take an analysis of the plant and watch it, and find out what the plant itself takes from the soil, what it constantly demands for its growth. When we take a plant and burn it, the ashes of the plant are the mineral manure which the plant has taken out of the soil, and it says to us, by the ashes we get, "That is the very substance we want, and must have, and will have, or we won't grow." That is the answer the plant gives us, and that is the way we get it. The chemist can take these ashes and analyze them, and find out exactly what they contain ; and we find that these ashes, as we should naturally suppose, after knowing something about chemistry, came from the rocks. The granite and feldspathic rocks, when ground and analyzed, are found to contain these very materials. But then, in ordinary soil, and especially in our soil here in New England, we find these particles of rock so coarse that many of them, even though they may be quite small, will remain hundreds of years before they are crushed down and dissolved. Now, that material in the shape of these particles, not crushed down, not dissolved, is of no more value to the plant than if it were ten thousand miles from the plant. The plant cannot feed upon these particles, and something must be done to crush and decompose them, so that the plant can get hold of them. That is the advantage that we have in the West, that our soils have been crushed and pulverized so finely, that these materials are given up more readily to the plant than they are in this section of the country.

Now, take ashes. You have what the plants have once taken up, and it is in a very minutely divided state, and it is in the state in which the plant needs it. Let us see what the result is. It is said that these ashes do a wonderful work, and there are several reasons why they do. In the first place you put upon the soil the very things that the plant needs, because they are the very things you have obtained from plants—the very things that the plants took up. That seems to be plain enough. But there is more than that. In many soils, there is a tendency to the formation of acids, which are prejudicial to the production of crops. If you put on live ashes, the free alkaline is present, and if leached ashes, the sub-alkaline is present, and it at once neutralizes the acids. So much is gained.

Then another thing. The free potash in these ashes is not only set free for the plant, but the ashes affect the particles of soil, and favor its decomposition, and therefore they not only give to the plants what they themselves possess, but they really favor the formation of more ashes in the soil.

Now, if we burn a plant, we shall find, ordinarily, that we obtain from it just about a given quantity of ash; not exactly, but there is a certain quantity which every plant must have, or it will not grow. Every man here, I suppose knows that all our plants take a great deal of their food from the air. They do not take as much as Liebig and others used to teach that they did,—I have found that out; they take a great deal of their carbon from the soil; there is no doubt about that. But they do feed largely from the air, especially our large-leaved plants, and it is absolutely impossible for them to do it, unless they can obtain from the soil just the amount of mineral manure which they need, because they must have, for every pound of wood they make, and for every single seed they make, a given amount of that mineral manure. If they cannot have that, they will not feed upon the gases of the air. They are just in the condition of a sick man, or a man with no appetite, who is brought to a table where there is an abundance of food; he cannot eat. There is the table and the food upon it, but the plants have no appetite; the gases pass by the leaves, and they cannot take them in. Now, put your ashes upon the soil and see that they have the mineral manure they need, and they are like a man with an appetite; he will eat anything; he will clear the table. Let the air come in contact with those leaves, the thousand mouths are open, and they take it in. Do you not see that by putting on mineral manures in this way, you are robbing the air, or taking out what nature put there for the plant to use? Here are two men, with fields side by side, in equally good condition. One man keeps his soil well supplied with ashes, as my friend Mr. Foote does, and his plants flourish, because they are able to take in the gases from the air. The other man has just as much air, but it has gone by his plants without giving them any nourishment, because he has not supplied his soil with mineral manures, and they could not take it in. That is the way. Pump the air. It is forty-five miles

deep; and when you have pumped it all clear one day, there will be just as much over your land the next morning as there was the day before, for the air is constantly changing. Keep tapping it. Put on the mineral manure.

There is another very important thing in regard to ashes, which is seldom referred to. One of the most essential things that we want is nitrogen, in such a form that the plants can take it up. Here is an atmosphere forty-five miles deep, as we say, but it is really a great deal more than that, and a very large portion of this atmosphere is nitrogen, the very thing we want to make manure of. We want to get this nitrogen into the plants, and if our friend Goessmann could only give us some recipe by which we could take this nitrogen from the air and put it into our manure readily and cheaply, we should not be obliged to go to the Chincha Islands for guano. We want something that will hold every particle of ammonia we have in the soil and that shall fix it as it comes from the air. There is more or less set free in the air from decomposition. If you have ashes, if you have any alkali or any caustic body present where decomposition is going on, instead of the ammonia set free passing off, you have more oxygen taken from the air, and you have nitre formed. You know that in old revolutionary times, they used to go out and dig up the soil under barns and houses, leach it, and get out the saltpetre that was in it, to make gunpowder. You can do it any day. Dig up the earth under any old barn, where the urine settles, and where the rain does not fall, and you will find it rich in nitre, which we want for plants. Throw ashes round a privy, where the urine is spreading, and where the water cannot come down, because the nitre is very soluble, and you will see, in the summer time, sharp crystals shooting, and you will find that these are crystals of nitre. And oftentimes, in stables, you will see the plastered walls covered with a coating that looks like frost. It is nitre. Decomposition has been going on; there is ammonia, and there is nitre formed. Now, if there is any decomposition of this kind going on, instead of its passing off in the form of ammonia, it is changed into nitre, and you have it there in the soil.

You see, therefore, how valuable ashes are. You see that, in the first place, they give back to the soil the very thing the

plant wants to live on; in the next place they favor the decomposition of the soil, and make more ashes; in the third place, they give an appetite to the plant, so that it can feed on the air; and finally, they tend to fix the ammonia in the form of nitre, which is one of the most valuable manures we have.

Our Western soils, as you know, are very rich and fertile. We carted ashes from the University and spread about forty bushels to the acre on a piece of blue-grass land. The soil is deep and rich naturally, but when we came to cut the grass we cut two tons on this land to one on land where the ashes were not applied. It would pay to give a good round price for ashes, even if their effect was to be exhausted on the first crop; but I have no doubt that next year, the effect will be still more marked. There is a great deal in this inorganic manure.

A MEMBER. Can you tell us anything about coal ashes?

Prof. CHADBOURNE. I will say that coal ashes differ wonderfully. Wood ashes, upon the whole, have about the same chemical composition; coal ashes are an entirely different thing. The ash of coal is made up from the inorganic material that was in the coal plants, just as in our plants, together with the sand, the slate, the clay, the iron, and all the materials carried in and deposited with the plants when the plants were deposited to make the coal. Therefore, you see that these ashes are made up largely, in many cases, of what we call fine sand and clay. Some of our finest coal, like our best Lehigh coal, deposits but very little material, and the ashes are composed mainly of the inorganic material in the plants; but then, they contain very little of those active materials of which I have been speaking. Those ashes, however, when they are fine, can be used to very good purpose as an absorbent. They can be used round privies and similar places, and put round trees, and they are better than fine sand to make a clayey, tenacious soil soft and friable. So that, indirectly, coal ashes are much more valuable than they have had the credit of being. But, directly, I have never seen any great advantage from them.

A MEMBER. What is the value of leached ashes as compared with unleached?

Prof. CHADBOURNE. That question reminds me of the philosophical remark of one of Dickens' characters, Jack Bunsby: "The value of that observation depends upon the application of

it." So the value of leached as compared with unleached ashes, depends upon the *application* you want to make of them. If the thing you want in your soil is potash, then of course you want unleached ashes, because it is the potash that is taken out by leaching. That is a thing that is sometimes almost entirely wanting. On some sandy soil you want that potash; there is no question about that. But, on the other hand, if you want mineral phosphates or sulphates, you will get more value for your soil, from the same amount of money, by putting on leached ashes. If you need potash, then what you want is unleached ashes. If you want phosphates, and those things that will continue to fertilize the land for a great length of time, then spend your money for leached ashes.

Col. WILDER. How is it with the soils of New England, that have been long under cultivation?

Prof. CHADBOURNE. They generally lack potash, as well as other elements. I will say this, that I would buy leached ashes if I could get them, and unleached ashes if I could get them, and all that I could get of both kinds, even if I had to pay more than Mr. Foote does. I used to have them hauled on to my land in Williamstown. I had a great pile there one winter; they froze, and froze dry, and there came a wind that took them and strewed them right across the field, and the last time I was there, there was a strip clear across the field to the fence where the grass was four times as high as it was anywhere else.

Col. WILDER. I am of the opinion that there is no mineral manure that we need so much upon our soils here in New England, that have been long under cultivation, as potash. I would purchase ashes at almost any price at which I could procure them. I should consider them a cheap manure at fifty cents a bushel. I have never used any manure on my soils that would produce such a wonderful effect as ashes. If I wished to have fair and beautiful fruit, I would apply ashes; and in fact, I have never applied them to any crop that I did not consider them the cheapest manure I could use. I derive this opinion, not merely from my own experience, but from the fact that on all our new, virgin soils we get the fairest crops of any that we grow. I saw that illustrated lately at the meeting of the National Pomological Society at Philadelphia, where the fruits from the new State of Kansas, although that State is not so

fertile as California, were quite equal to any of the fruits that were exhibited from California. I am not prepared to say that the fairness, or beauty, or size, or excellence of those fruits was derived from potash; but we all know that on lands newly burnt over we get the fairest fruits, the finest vegetables, and the best grain. I have always been very much in favor of the use of ashes.

I was much pleased with the remarks of Prof. Goessmann, and especially with the caution that he gave us. I consider salt a very dangerous article to use, unless it is used with great caution. It may be owing to the region where I live, so near the ocean; but I must say, that in all the applications I have ever made of it, even to asparagus beds, which I know will take a great quantity of it without injury, I have never yet seen any benefit resulting from it.

Mr. THOMPSON. I will explain the method by which I have arrived at a number of results by the manufacture and application of manures this past year. First, I will state how I became interested in the matter of using ashes.

In 1832, there was a lot of land of five acres adjoining my father's farm. It was purchased by a man who was a shoemaker, and was new to the business of farming; that is, he had not been brought up to it from his youth. The land had been worn out, both as pasturage and as a mowing lot, until it got so poor that it would not give more than three-quarters of a ton of hay to the acre. He had an idea that he could purchase manures and make the land better, and make a profitable business of farming. He bought all the leached ashes from the soap-boilers, paid seventeen cents a bushel for them, and carted them two miles; all the manure he could get from the livery stables, and all he could buy from other sources. He used to give fifty cents a load then—twenty bushels to the load. He went on to the lot and applied his leached ashes to about an acre, "fore and aft," as we sailors say. Next he applied his barnyard manure that he bought in the vicinity, of those who were not so much interested in producing crops as he was, and sold their manure, instead of using it on their own land. Then he applied the livery stable manure to another acre. The result was right before my eyes every day while I was on the farm adjoining it. The benefit of the horse manure was evident in the first crop to

such an extent that the land yielded nearly three tons of hay to the acre. The result of the cow manure was a medium between the crop of the previous year and the crop produced by the horse manure. You could hardly perceive that there was any particular advantage the first year from the leached ashes; the next year you saw the advantage, and he run it five or six years before he applied any more, and then he broke it up. The third year ashes were applied where the horse manure was, and you could see the effect as plainly as you can see these aisles between the benches. The cow manure ceased to show much effect the third year; the ashes, I think, did not lose their effect upon the soil for years and years.

Ten years ago, I had occasion to oversee the laying out of a park for our agricultural society. I wanted to make the track as hard as I could, at as small expense as possible. If we used clay, we had got to cart it two or three miles, but we could readily get coal ashes carted to the park, to get them out of the way as waste. I got some as good soil as I could, and put it on the track—our common poor land that wouldn't spindle corn in two years, if it would last so long. We mixed that soil with a little of the yellow loam, and then ploughed and harrowed it, and applied these coal ashes to it, two or three inches deep, and in three years from that time I mowed it with a mowing machine, and I think I cut a ton and a half of as good clover as ever grew in the world on that park; and to-day, it is in such a condition that it would grow fifty bushels of corn to the acre, if you turned the soil up. That is simply the result of the application of coal ashes.

I bought last year all the coal ashes I could get carted to my place for twenty-five cents a load of sixteen bushels. The folks thought I was crazy to have coal ashes tipped upon my farm. I mixed these ashes with peat muck at about the rate of three loads of muck to one of ashes. Early in the spring I had it shovelled over. There was part in the ground and I kept moving it until it was thoroughly composted. I had a piece of land which was sowed to rye, which had had corn on it the year previous; the manure was ploughed in, and then a spoonful of Pacific guano applied to a hill; the yield was fifty-eight bushels to the acre. I seeded that in October of last year to rye, and did not put on any manure. In the spring I wanted

to test the value of this compost of coal ashes and peat, and I had a man drive in with a team, and scatter this compost over strips of the usual width, leaving every alternate strip. I then sowed the whole, and rolled it over; I did not harrow it. If you could see that field to-day, you would see that the seed has taken firm hold where this compost was spread,—the clover is developed handsomely; but the strips where I put none of this compost are almost as barren as this floor. The seed did not take at all, through the season of drought,—for we had five weeks of drought, as the Irishman said, in August.

Now, I have had the whole lot covered with a compost that I make of cow droppings and peat, for the next year's trial; and I am in hopes that I shall then see the effect of this compost of coal ashes and peat, in comparison with barnyard manure composted with peat.

A MEMBER. Will you please to tell us what the soil is?

Mr. THOMPSON. The soil is a rather dry, sandy loam. Perhaps I ought to say that I reside in Nantucket. I have had it stated to me that the refuse of gas works was useless. I had some of it carted to my place, and had fresh peat muck mixed with it—about one load of the gas lime (twenty bushels) to four of the peat muck. In March I had my men cart salt water right from the dock. I used three hundred and fifty gallons of salt water, equal to a bushel of salt, but in a better condition to mix, as it is ready to compost with the peat and lime at once. I let that remain until April, and then I had it applied broadcast to grass land, by the side of barnyard manure, and when we mowed the grass, I could not tell the difference. This land was a wet, loamy meadow, over a peat bottom. I planted potatoes, with this compost in the hill. The potatoes were not equal to those which were planted in kelp, or kelp, peat and lime.

I also experimented with salt, lime and peat, on potatoes—one bushel of salt to one barrel of slacked lime, thoroughly dissolved in three loads of peat. The crop was almost a failure. Peat, with twenty pounds of soda ash in the dry, then dissolved thoroughly, gave a very fair result, but not equal to the kelp, or the kelp, peat and lime.

My objects in these experiments was to ascertain what I could produce a crop with, at the least expense. It costs high to get kelp and cart it seven miles and a half, or else give $1.50 for a

load of say, a quarter of a cord. I find that makes the best potatoes, but, as I say, it is an expensive manure; therefore I made a compost of one load of kelp, two loads of peat, that I got on my own land, and say a barrel of lime. The kelp carried the salt, and the lime was slacked and dissolved, and it was composted in alternate layers of peat, and kelp and lime. The potatoes produced in the hills to which this compost was applied were as smooth as they could be, and almost all large, where they grew from a cutting of one eye to each piece. It was not a large yield, only twenty-five or thirty bushels of "Early Rose" from one bushel treated in that way; but they were all large, fair, merchantable potatoes.

My experience and observation in regard to wood ashes would induce me to give as Colonel Wilder has said, even fifty cents a bushel if I could be sure of getting them at that price. I will say, that the farmers on Long Island send vessels down to the State of Maine to bring up ashes by the cargo, and it is these ashes which have made the lower end of that island into vegetable gardens for the city of New York.

Mr. Colt. Can't you apply your peat without composting it?

Mr. Thompson. Yes, sir, but it would have an injurious effect, because, spread broadcast in the fall, or laid out so that the frost would act upon it, the acid in it would rather have a tendency to retard vegetation.

Mr. Colt. Then you think the coal ashes take the acid out?

Mr. Thompson. Yes, sir; any alkaline matter would neutralize the acid in peat.

A Member. Have you experimented with coal ashes alone, and if so, with what result?

Mr. Thompson. Yes, sir. I do not know that you would call the ashes I have applied coal ashes, because, whenever we speak of the use of coal ashes, we are immediately combated with the assertion that all coal ashes are more or less impregnated with wood ashes; but the amount of wood that is used is so small, simply a few chips to kindle the fire, that I must think the quantity of wood ashes is too small, in proportion to the whole amount, to have any appreciable effect. The whole effect, I think, is from the coal ashes, and it is a good effect. You may put them right on the soil, especially if it is of a clayey nature or low ground, and you will see the grass come in

very readily, almost as readily as with the ashes from peat. You may take off the whole of the top soil, and apply peat ashes for a year or two, and it will all come in with white clover, without any other application, so that I would be willing to purchase ashes under any circumstances. I have just bought a farm, the pastures of which have been run down, and which I am determined to cover with all the ashes I can find, to see if I cannot renovate them.

A MEMBER. Does Mr. Thompson mean that coal ashes will produce white clover?

Mr. THOMPSON. I do, on our land. I will say, that many years ago, I rode over our island with Judge Bishop, where there is a moss growing that will destroy almost all vegetation. Then in 1832 and '33, there were 14,000 sheep on our island, and they took out the last elements, it seemed to me, of vegetation, and there was nothing but organic matter left there. The Judge said to me, "Why, my dear sir, put on coal ashes; harden up your soil, so that it will not blow away; then the crops will grow."

J. F. C. HYDE. I did not intend to speak this afternoon, but this discussion leads me to say a few words.

I have used wood ashes on strawberries with the most gratifying success. I have raised the greatest crop of strawberries that I ever raised in my life from their application. I do not believe that I can go astray in the use of wood ashes. But as that has been said a great many times, and as you all believe it just as strongly as I do, I will pass on to coal ashes.

I have used coal ashes sometimes with pretty good results. It seems to me there is a difference in the coal. I have used a great many cords of coal ashes which I have procured for the expense of carting, no charge being made for them. I have carted them from the village near which I reside, Newton Centre, to my own ground, and screened them there, or I have screened them at the place where I obtained them, and then carted them away. I use a screen such as we use to screen gravel for the highway. I have used the ashes from both red-ash and white-ash coal. I am not learned enough in this matter of coal to say that the red ash is richer in those materials that go to benefit the soil than white ash; I can only say, that I have had the best success from the ashes obtained from the

red-ash coal. Of course, much depends upon the place you get coal ashes from, or the way in which the coal is used. If your ashes are obtained from kitchen fires, kindled every morning, you see, of course, that you get a large amount of wood ashes; but if you get them from a furnace where the fire is kindled the first of November, and does not go out until the next May, and not a stick of wood is used during all that time, you get, of course, no wood ashes, only coal.

My last experiments were made with coal ashes obtained from such a source, where no wood was used, and I must say, that beyond serving a good purpose as an absorbent, I do not believe they were of any value; and as an absorbent, they were no better than sand would have been. But then, it may be, as Prof. Chadbourne has remarked, that they act mechanically upon the soil, and therefore may be used to advantage in some places.

I pass to peat ashes. These are generally regarded as of little value, because it is supposed that they contain very little potash; but I use peat ashes with very great advantage, and I would pay something for them. I use them as an absorbent. I put them into privies, to absorb the liquid, and then mix them with muck, and use them in this combination with very gratifying results.

Now, to return to coal. I cannot agree with Mr. Thompson in regard to the use of coal ashes upon grass land; or I should say that they do not have that effect upon the lands about Boston that they have down in Nantucket. I have used them upon grass land, and noted the results very carefully; I have used them on wet land and dry land, and I could not see a particle of difference in the grass. If I use wood ashes, I can write my name in the grass almost, and I can bring in white clover where there did not seem to be a particle of it before, so that it would do your eyes good to see it. Coal ashes never produce such a result with me.

One word in regard to salt. I have tried salt to some extent, and I agree fully with what Col. Wilder has said, that salt is of no sort of use with us about Boston, and I have great fears about using it. I have seen it applied to asparagus, so that not a single living thing could grow in the bed but asparagus, and the soil seemed scorched and barren; and yet that asparagus did not do nearly so well as my friend Moore's, where he uses

other manures. What is the use of applying salt, if it produces no effect? I know that in some places among these hills, you can apply gypsum, and write your name in the grass, but with us, you might as well apply so much dust from the middle of the street; it would do just as much good.

I only speak of our locality. I have spread salt upon grass without the least result. The notion has prevailed among nurserymen and orchardists, that we must apply salt to plum-trees, and one man went so far that he applied it until he said he could taste the salt in the leaf of the plum-tree—which I did not believe; but I never could see any good results coming from that. I am free to say, however, that I do not profess to know but very little about it, except from my own observation and experience. But I cannot say that I have seen the least beneficial result from the use of salt.

Mr. SLADE. We are in the habit of using considerable leached ashes, coming from the northern part of New York State. We have an idea that there is a vast difference in the quality of those ashes, depending upon whether they are hard-wood or soft-wood ashes. I call upon Prof. Chadbourne to give the farmers a simple rule by which they can determine whether they are valuable or otherwise.

Prof. CHADBOURNE. The pump sucks! (Laughter.) Of course, any chemist can analyze a given specimen of ashes and tell exactly what they are; and in almost all of our agricultural books you will find an analysis of the ashes of all the common woods that are burned. I know of no way myself to direct the farmers, except that if they know where the ashes are produced, and have a book like Johnston's, where these analyses are given, they can see about what the average composition is. As to giving any simple rule, it is utterly impossible for me to do it. So far as I am concerned, I say the pump sucks there.

Mr. SLADE. Take, for instance, a few soft-wood ashes in a saucer and apply vinegar, will the result be the same as it would if they were hard-wood ashes?

Prof. CHADBOURNE. It will not be the same. The ashes differ in the amount of free potash they contain; and the more free potash they have, the more vinegar it will take to deposit it. But then, the vinegar itself is a variable quantity, and you would have to consult a chemist to get vinegar of a certain

strength. These are some of the points which I intend to discuss to-night, to show the utter unreliableness of three-quarters of the experiments that are made, because we do not know the strength of the vinegar.

Mr. GOODMAN. I want to say a few words in behalf of my friend Mr. Salt, who, I think, has been badly treated by my friend Col. Wilder and other distinguished gentlemen here. In the first place you must recollect that these gentlemen who are advocating ashes against salt, (and I have not a word to say against my friend Mr. Ashes) come from the seaboard, which has naturally an atmosphere saturated with salt, and that salt is not so efficacious there as elsewhere ; but I apprehend that no one can deny the great uses of salt in connection with agriculture, any more than he can deny the relation of the atmosphere to the ocean. It may be a matter of inquiry how far those countries which are notorious for their verdancy and greenness, for the richness of their pastures and the quality of their grass, for instance, Ireland and England, are influenced by the saline particles which emanate from the ocean, as it courses by these islands and modifies their atmosphere. Therefore, when you undertake to say that salt has no influences upon certain soils, you must not charge it entirely upon salt, until you analyze that soil, and analyze other soils, and see whether there is not a difference in the effect.

Now, in relation to all these inorganic manures, there is no doubt that it can be laid down as a prime principle, that they are all beneficial, because the soil is made up primarily of inorganic matter. We know that our soil is composed of the rocks that have been ground to pieces by the process of abrasion that has been going on for ages. Therefore, these inorganic matters, when exhausted from the soil, can be practically replaced. On the other hand, we can go through the process of burning the plant, and undertake to make from the ashes a perfect manure, so that the plant will grow as strongly and in the same condition as in the natural state. It is just as impossible as it is for those French chemists to succeed, who have undertaken to introduce life by a mechanical process, instead of the old natural way. I apprehend that life can be introduced in only one way, and neither French nor any other philosophers can bring life into the world by mechanical or chemical means.

Now, when you undertake to make perfect manures from the salts or from the ashes of a plant, you are at fault, because you have not the appliances for appropriating these elements which nature has. You cannot penetrate into the mystery of the veins and arteries of the human system, or into the mysteries of vegetable physiology, by which a tree is produced, so that you can do it artificially; you can only approximate to it. We can only approximate to what are the best manures for certain vegetables and plants; and therefore, when Mr. Hyde and Colonel Wilder tell us that they tried this manure and that manure on their pear-trees or their strawberries, we rely upon what they say, because they have tested theory by experiment. But when Colonel Wilder tells me that he would not apply salt, I tell him that he has not lived yet on the hills of Berkshire; but I hope he may, and change that meagre climate of the eastern portion of the State to the strong, health-giving influences of our Berkshire hills.

Now, when you come to apply these things to the soil, you have got to look at them just as the doctor looks at his patient. If an allopathic doctor is called in to a person who is sick, the first thing he does (I say it with all deference to my allopathic friends), is to get a bolus down his throat, and experiment upon him, see how it affects him; and after a while, by continually experimenting, he may get hold of the right medicine. But, in my opinion, the homœopathists should be our exemplars in the treatment of the soil, because they first inquire into the previous conditions of the man; they ascertain, in the first place, what hereditary influences he has derived from his parents; they inquire what have been his habits of life; in what atmosphere he has lived; they watch the condition of his blood, and then they are able to bring out and apply the medicine which will be most likely to restore the patient to health. So when we apply these manures, we want to find out the condition of the soil, what has been grown there, what elements are exhausted, and taking all these things into consideration, we are able to apply the manure specially adapted to meet the necessities of the case.

Now, as to this matter of salt. As the Professor has told us, there is no question that it was used centuries ago as a manure, by men who thought themselves as wise as we are—the Greeks

and Romans—with decided advantage. Our agricultural histories tell us that among the ancients it was one of the most valuable manures. When you get among hills as far from the ocean as ours, you will find salt is a beneficial manure; but you must not use it on our fields as you would use it on an asparagus bed. No man would use guano as he uses other manures. You cannot use superphosphates as you use any other manures. You cannot use any mineral manures as you use barnyard manures. They must be used with great caution. I apprehend that salt used as we use barnyard manure, would be injurious; but if used with discretion, on certain soils, there is no doubt that it will be of great benefit. Take a country like this, where oats are a valuable crop. One of the greatest complaints among farmers is, that they do not stand up; and what is the reason? The reason is that the silicate in the soil is exhausted. If you apply salt, and restore that, you will find that your oats will not fall down. When salt is properly applied to our soils, you will find that a stiffness is given to the grain, and that it is beneficial in that respect.

Nitre from the powder-houses has been used in Connecticut, and in some parts of Massachusetts, with great advantage. No more luxuriant crops can be produced by any known fertilizers, than by the proper use of these saline manures.

Salt is also beneficial in destroying cut worms, which so much trouble us with our vegetables. It is useful, also, as we know, in connection with lime and peat. I apprehend, therefore, that we cannot condemn the use of salt as a manure. It may not be of so much service in some parts of the country as in others, but there is no doubt that in many sections, and especially here, it is a valuable manure.

But after all, in the discussion of mineral manures, we must concede this,—that whatever value they may have, they come in, as a general thing, only in aid of the manures which we ought to make upon our own farms. There is no *succedaneum* that will take the place of barnyard manures, properly made and properly composted, the liquids as well as the solids carefully preserved; because, when that manure is properly applied to the land, you get all the benefits you can get from any or all the mineral manures together. You have there, probably, the most perfect manure that can be made; and you will find that

the plants themselves, which Prof. Chadbourne tells us are the best judges of what they want, will extract from this barnyard manure all those materials, organic and inorganic, that they need, and appropriate them in the best way. Without saying a word against the proper use of bought manures, it seems to me that every farmer errs when he does not undertake, on his own farm, to manufacture, to the fullest extent of his ability, those manures which are made by his cattle, and which, in the bodies of the animals, have had their solubles and solids mixed in proportions which no chemist can imitate; and I apprehend that we get there as near a perfect manure as it is possible for the mind of man to conceive.

QUESTION. Have you used salt on your farm?

Mr. GOODMAN. To some extent.

QUESTION. Will you state how, and what was the result?

Mr. GOODMAN. I have only used it as a top-dressing, and its effect was very good.

QUESTION. How much?

Mr. GOODMAN. I have scattered it just as I would scatter gypsum; just as little as I could.

QUESTION. Coarse or fine?

Mr. GOODMAN. I have used refuse salt, cheap salt, which I get from the stores in New York. I have never seen any injurious effect upon the land to which it was applied. I have always found it beneficial.

Col. WILDER. I rise, not for the purpose of controverting any of the propositions of Mr. Goodman, but to say that I suppose it is understood, that in the remarks which Mr. Hyde and myself made, we only spoke of the use of salt in our region. I think I made that remark. What we come here for is to get experience. We want some gentleman in this assembly who has used salt, to tell us how much he has used to the acre, and what have been the results. We all know that salt is a good substance to destroy worms; but I noticed that Prof. Goessmann cautioned us in regard to its use. Mr. Hyde and myself have both tried it, with our usual care, and found it disadvantageous. I do not doubt that salt can be used in combination with manures with good results. I know it can be used with lime and peat with great advantage; but in that case the salt undergoes a chemical change; it is not salt, in the proper sense.

I did not wish to be understood, neither do I now, as saying that salt may not be useful on the hills of Berkshire; but it is a settled fact, from the experience of my friends and myself, that on the seacoast no good result follows its application, even to an asparagus bed.

Mr. BEEBE of Beartown. I have used salt, from a bushel to three bushels to the acre, with good success on oats, potatoes and wheat. Grass is very much improved by the application of salt as a top-dressing when the land is seeded down. I simply sow the salt on the sod with the grain, harrow the whole in together, and then put the grass-seed on top, without stirring the soil.

In regard to the feeding of salt to animals, I think it likely to be very injurious, unless great care is exercised. I believe that nine-tenths of the cattle that are said to die of murrain in New England, are killed by the feeding of salt to large numbers of cattle, without taking proper care that the young animals do not get too much. I have seen several die in my pastures in two or three hours, when inexperienced men have come in and thrown down salt.

Take one bushel of salt and three bushels of marl, and let it lie four months under a shed, and then add five bushels of this compost to a cord of muck, and I warrant you one of the best manures that was ever made in Berkshire County, for all your sandy land. That is a recipe Prof. Mapes gave my brother for twenty dollars, and he tried it on sandy land near West Stockbridge, ten or fifteen years ago, and that land still produces double the quantity of grass that is yielded by the same quality of land adjoining. I think, also, that it is the greatest preventative of rot in potatoes that I have ever used.

I have used salt on land that I planted with oats, and find it very beneficial in stiffening the straw, as well as in increasing the weight of the grain. It raised my oats six inches above the crop standing side by side, with the same cultivation except the application of salt.

Mr. BUTLER. I believe that salt on our Berkshire land is decidedly beneficial. Col. Wilder undoubtedly will tell me that his animals require little or no salt running at large in his fields.

Col. WILDER. Not a bit.

Mr. BUTLER. I thought you would say so, sir. Now, my

animals, and those of every other Berkshire man, eat salt with the same avidity that they would meal or grain, once or twice a week.

One gentleman speaks about salt injuring animals. I know perfectly well that that is so; and I know that it can kill plants; but this capacity to kill, to my mind, certainly proves it to be a benefit, if properly used. My friend Judge Bishop, of Lenox, once bought some salt in New York at a low figure, and sowed so much upon his grass land that it entirely killed the grass for a year or two; but after that he had better grass than he ever had before, or ever knew the land to produce; and that lot has continued to bear grass from that time, some six or eight years ago, to this day.

The fact that animals refuse to take salt, is sufficient proof that the plants do not need it; and the fact that the animals in this part of the State will eat salt twice a week, proves that the land will be benefited by salt. I have bought all the refuse salt I can get for six years, and composted it with my barnyard manure. On one side of my barn there is a gravel and cement floor, and I use considerable straw litter on that side, and compost the salt with the manure on that side. I can mark the place where that salt goes just as plainly as I can see these aisles.

So far as the amount is concerned, I believe if a man applies four bushels of good salt to the acre and ploughs it under, it will be no injury. One of my neighbors found that the wire-worm had got into his corn. He replanted it and put a teaspoonful of salt on top of each hill after planting; there came a rain, and he had no more trouble with the wire-worm. The corn did well.

Mr. Foote, of Williamstown. If any gentleman present has experimented with ashes, live or leached, upon the potato crop, I would like to have him state the result of his experience. In a single experiment that I made, the ashes were rather detrimental than otherwise.

Mr. Butler. Last spring I planted a lot of potatoes, and I told my boy to put a moderate handful of unleached ashes in each hill. He did so until he run short of ashes. I planted about three-quarters of an acre with ashes, and about one-quarter without ashes. The potatoes had no manure other than the ashes. There was a very marked difference in favor of the

ashes. I think it would have paid to give seventy-five cents a bushel for the ashes, if I could have bought them, for the rest of the field.

Mr. FOOTE. I made but one experiment, and that was in connection with plaster. The ashes gave an increased vigor to the vines, but the yield of tubers was less than where ashes were not used.

Mr. BRIGGS. I would inquire as to the use of ashes from lime kilns.

The PRESIDENT. I have used those ashes myself. I do not think that lime on the soil in my vicinity does very much good, because it is a magnesium and limestone soil. I should prefer ashes without any lime in them. I have never failed to see a benefit from ashes on any soil, but I do not think that lime does much good on our soil.

Adjourned to evening, at 7½ o'clock.

EVENING SESSION.

The Board met at 7½ o'clock to listen to a lecture on

THE OBSTACLES TO THE PROGRESS OF SCIENTIFIC AGRICULTURE.

BY HON. P. A. CHADBOURNE,

President of the University of Wisconsin.

It is fashionable to clamor for science. And to be considered "scientific," is the ambition of many who neither know what science is nor what constitutes a scientific man.

Science,—and I speak now only of that which relates to matter,—science is Nature interpreted, but not interpreted in detached portions, as one might learn the meaning of separate words and sentences scattered here and there through an author. To constitute science there must be such a reading of Nature in some one of her chapters, that the thought in it shall be grasped. And when, from the accumulation of facts by observation and experiment, the searcher is able to read the thought and put that thought into language as a general expression legitimately derived from those facts, he is a scientific man,—that is, he has scientific power, although he may have but little learning. And that general expression or interpretation of the facts is science itself. In other words, "science is knowledge classified with respect to principles."

Science, then, is in a certain sense, the product of the human mind. Science simply marks the progress of the great minds, who have given a correct interpretation of Nature. We have science, because men with scientific power are always able to step beyond the boundaries of present knowledge into the regions of the unknown, and there from signs unseen by other eyes or unintelligible to other minds, they are constantly sending back additional readings or corrected proof of the book of nature.

There are men in the world who fancy themselves to be linguists who can only read translations, and cannot stir an inch beyond where their "ponies" carry them. So there are men who claim to be scientific, simply from the knowledge they have of what others have done without the least power to do for themselves. There are men who can give you the names of whole cabinets of minerals and yet know nothing of the science of mineralogy, though they are called mineralogists. So a man may know the names of plants and animals and astonish his friends with the extent of his knowledge in this respect, and yet be entirely innocent of the science of botany or zoölogy. It should be better understood than it is, that no amount of facts of themselves constitutes science and that no amount of scientific knowledge even, necessarily makes a scientific man. A man may even be a good observer of certain phenomena, so that his work may have great scientific value, and yet he may not be in a true sense a scientific man but merely a skilful artisan.

If we accept these statements we shall see that we have but a small body of scientific agriculture though we have a vast amount of agricultural information that may be made the basis or materials of science, when it can be separated from that which is unreliable, and of merely local value. And we have a smaller body of scientific agriculturists than is generally supposed. Many of our observers and experimenters have not been properly trained, and our best interpreters have not always had reliable data for their conclusions. And others having great power to observe and to collect facts make their generalizations correspond to some preconceived notion or hypothesis. Their great learning often gives currency to their opinions, even when entirely unsound, or at least of doubtful soundness, when tried by their own facts. Thus Darwin has given us some books

that as collections of facts are of great value to agriculturists. But to the minds of many, his facts disprove his own theory, while others accept the theory as legitimately drawn from the facts, and many more accept it on account of its boldness and the acknowledged learning of its author.

Science is of slow growth. And if at times there seems to be a sudden advance, we shall find that materials had long been preparing and at the right time the master mind appeared to utilize those materials and by his brilliant results arouse other minds to great activity in the same fields. Linnæus and Cuvier are good examples of such great masters, not to mention some who are now living.

Every science has its own obstacles in the way of its advance. The more complex the science, the greater the number of those obstacles. The nearer a science comes to every day life, the more prejudice does every new movement encounter, and the greater becomes the difficulty of reaching truth amid the abundant conflicting testimony. I need only mention the sciences of medicine and political economy to remind my hearers what diverse views are held by men of apparently equal ability and with the same opportunities for observation.

Agriculture has its peculiar difficulties as well as such as are common to all complex sciences. It is well for us to set those difficulties distinctly before ourselves and the community, that we may see how to attack them successfully, and have that aid from the community which the work demands.

Agriculture as an *art* has in the past been sufficient for most of the world, and the same is true to-day. The world is supplied with food. The question to-day all through the great West is, not so much how they can raise more, as it is where they shall find a market for what they have. And right at this point we meet an obstacle to the progress of scientific agriculture where many people supposed it would have the most favorable conditions for advance. The very richness and boundless extent of our soil is an insuperable obstacle to the advance of scientific agriculture in some parts of our country. Why talk to a man of scientific agriculture, when all the agricultural science in the world cannot prepare such a soil for our great staples as he can buy for a dollar and a quarter an acre—where the only question is how to get the seed in, the grain harvested and carried to market! You may talk to

such a man of steam-ploughs and reapers and threshers, and he will listen to you. Anything that will enable him to rob the soil, he will have at once and bless the maker. But you might as well persuade a man in Massachusetts to bottle up water in winter lest all the springs and wells should fail in summer, as to induce men so situated to spend time and thought and money on scientific agriculture. They say they cannot afford to do it; and they cannot—they cannot afford at the price they sell, to do anything but rob the soil.

But I propose to narrow my discussion and consider the obstacles in the way of those who really undertake the work as is done by this Board and by many such bodies of men, and by others who see the coming necessity for scientific agriculture and believe in its possibilities. I propose to speak especially of

FACTS AND THEIR INTERPRETATION.

"Now what I want is Facts," said Mr. Gradgrind when laying down the principles of instruction. "In this life we want nothing but facts, sir, nothing but facts." To the first proposition we agree fully, we want *facts*. To the second, that we want nothing but facts, we object entirely. Facts are bricks or blocks of stone, without which the building cannot be raised, but their interpretation is the testing of every brick or stone and the combining of it with others, so that it shall become of use as part of a building rather than the part of a pile of rubbish of no possible use in itself.

As agriculturists we want facts and their interpretation, even if we must be indebted to others for both of them; but more than this, we want power to secure facts for ourselves, and to interpret them wisely for daily application in the business of life.

A fact in science is a thing established by observation or experiment. It is a fact that all bodies are attracted by the earth; that some plants are killed by frost and others not injured by it; that water will not rise in a pump over thirty-six feet, and that as you ascend a mountain water will boil at a lower temperature than at its base. These are all facts,—things not made or controlled by man, but learned by him.

Now a full interpretation of these facts, as I use the word interpretation to-night, includes two things,—first, the giving of

the reason why they are so, by referring them, if possible, to more general principles, and secondly, the drawing of conclusions from them for our guidance in practical life.

The last work seems to be the most immediately profitable, but the human mind is so constituted that it always seeks for the reason of a thing, and in doing this it often gains new views that aid in securing either other facts or some general principle from those already known. This is illustrated many times in the history of the inductive sciences.

If asked why bodies fall to the earth, we can only speak of gravitation, which is simply giving name to a force of which the fact of the falling of the body was the expression. If asked why cucumbers are killed by frost and spruce trees are not, we can only answer that such is the nature of the plants. We have gone as far in our explanations as we can go.

If asked why water will rise only so many feet in a pump, we reply that the water is forced up by the weight of the air. This is such an explanation of the fact as will enable us to guide our actions in other cases. For knowing that the weight of the column of water in the pump balances by its weight the column of air, we infer that a heavier fluid cannot be raised so high, and that a pump upon a lofty mountain will not raise water as high as the same pump would in the valley.

By knowing the cause of these phenomena then, we gain an advantage because we modify results by changing the conditions under which the cause acts, and may thus be said to have power over the causes.

In regard to other phenomena we cannot affect the causes or their conditions of action at all, but we can do much in modifying their results. We cannot control the movements of the sun in the heavens, but we can learn to protect our plants from his scorching heat in summer, and from the intense cold of winter. We cannot control the falling of the barometer, but we can do something to protect ourselves and property from the storm which it indicates. It is wonderful what power, offensive and defensive, in securing the good things of life, a knowledge of the facts of nature and their interpretation will give us.

As agriculturists then, I say, we want certain facts established. We want those facts traced back to their producing cause in every

case in which it can be done, and we want the facts made the basis of sound induction for our use.

It is in this way alone that every science advances; and unless agriculture can advance in this way, it can lay no claim to be regarded as a science; while it is compelled to rest upon isolated facts alone, it is bald empiricism. And while its supposed facts are many of them errors, or at most of only local value, there must be constant blundering even when dealing in facts alone, and any induction from erroneous data must be useless or worse.

Certain agricultural facts are of no use to science. It may be a fact that a certain hillside produces excellent grapes, but that fact alone is of no value except to the owner or future purchaser of the place. But now give us the composition of the soil and the other conditions which produced the crop, and you have given us something which will guide us in our attempts to secure a grape crop in other places. But you say the conditions are complex, and to analyze them and give the composition of soil, the influence of climate and peculiar cultivation, is a difficult thing to do. Exactly so. And this leads me to observe that as we come into the kingdom of life, we find every fact depending upon so many conditions, and these so intricate in their nature, that, while the fact may be accepted by all, it may be as useless in science as the fact that my neighbor has a vineyard where grapes grow well, while neither he nor any other person can give any reason why they should grow there at all. Almost everything connected with practical agriculture has much of this complexity. Certain facts of a general nature are known to all in regard to plant growth and the propagation and care of animals. But when a question of interest arises, put that question into an agricultural paper and then cut out and paste side by side the answers you obtain. Do this with every question that arises connected with the management of any farm, and you will have a common-place book that will be amusing if not instructive. In one point it could not fail of being highly instructive, however; it would show the number of questions settled — that the number of facts that can be relied upon in practice on the farm or as an aid to induction is much smaller than is generally supposed; while the questions yet undecided are literally without number.

Professor Agassiz said four years ago, that a scientific man could ask more questions in ten minutes than all the Agricultural Colleges could answer in a generation; I think he said, *in a century*.

If the Agricultural Colleges with their improved methods and appliances have such a work before them to settle these questions, it will not seem strange to us that such complex questions have not been settled by the occasional imperfect experiments and observations that have from necessity been made. Fortunate has been the man who has observed and learned how to manage his own grounds. But in many cases such fortunate ones have made others unfortunate by inducing them to undertake the same thing, when difference of locality or some other unknown quantity, changed the result.

I wish to call your attention especially to the great difficulty we have in securing reliable data from those not trained to observe. Persons may be intelligent, and learned even in some directions, and yet if they have not been trained to scientific processes of observation and experiment, they are very likely to be imposed upon or at least to leave out some important element essential to be considered in drawing sound conclusions. Every scientific man sees accounts of certain experiments or observations relating to his own department of study, in which the error of the experimenter or observer is perfectly apparent to him. Some of these mistakes are made as regularly every year as the leaves come out or the crops ripen.

Almost every year we see accounts in the papers that sulphur has fallen in a thunder shower. Where lightning strikes there is a strong odor, very much like the smell from the burning of gunpowder. Thomson poetically represents the thunder cloud as charged with bitumen and sulphur. Putting all these things together, there is a notion on the part of many that sulphur is in some way connected with thunder and lightning. And when after a powerful thunder storm they find a fine, yellow powder around the edges of the pools, it is not strange that they should suspect it to be sulphur. But the strange thing is that this yellow powder, which is simply the pollen of plants, should be mistaken for sulphur every year, when the simplest test, that of burning it, would show it to be as unlike sulphur in its properties as any substance well could be that would burn at all. A

few years since a bag of this yellow powder was sent to me by some good people in Ohio. They stated that it fell in a thunder shower, which was true — that it looked like sulphur, which was also true — *that it burned like sulphur and smelt like sulphur*, both of which statements were utterly false. It burned like fine sawdust and smelt like sawdust. But these good people, having a theory to sustain, cheated themselves as to the burning and odor. I suspect to this day they think I do not know sulphur! Now a great number of so-called facts that men rely upon and dispute about, have no more claim to truth than that pine-tree pollen had to be called sulphur.

But when we come to the work of those who profess to observe accurately, whose observations have been tabulated, and from which conclusions are daily drawn, we often find most important mistakes. Those who have experimented with great care, after a time often discover that there was some element not taken into account, which entirely vitiated the result. The experimenters in our agricultural colleges are finding these mistakes so common in the experiments which they are repeating, and so frequently detect errors in their own experiments, and so often have results that they cannot account for,—oftentimes apparently contradictory results,—that they now draw their conclusions with the greatest caution, demanding a large number of experiments for several successive years to establish any result. And then they understand that in many cases these results, established with care, are of use only in a limited locality. It ought to be said, without fear or favor, that the isolated experiments which are reported in our papers, though fairly stated, are oftentimes worthless—that they often do more harm than good by inducing others to attempt the same thing, while some important conditions that rendered the first experiment a success, are wanting.

The Agricultural College of Michigan has been in successful operation longer than any other in this country, and has carried on more extensive experiments than any other, under men competent to conduct the experiments, and with every appliance which could be desired for securing the best results. And what is the first result of these experiments? Why, to throw distrust upon a large proportion of the experiments that have been recorded and tabulated for use. Professor Miles told me that

he found almost all sets of experiments worthless except those of Lawes and Gilbert in England. Of course he did not mean to say that no accurate experiments have been made; but that they have been so intermingled with defective experiments, and vitiated by conditions not reported, that they are almost worthless as data for general conclusions.

As an illustration of the extreme difficulty of eliminating disturbing causes so as to reach sound conclusions, I give a few of his experiments and their results as found in the Report of Michigan Board of Agriculture for 1868.

Two acres of land were selected, with soil of friable loam "of apparently uniform character." From that plat ten small plats were taken, so as to represent fairly every portion of the two acres. All the work except the ploughing on all the pieces was done on the same day. In other words, these ten plats of ground, to all appearance alike in the beginning, were cultivated and treated exactly alike. This uniformity in soil and culture might have been expected to give uniform results at harvest. But we find among these plats a very great diversity of yield. One yielded, of shelled corn, at the rate of 51.28 bushels to the acre. Another 76.14 bushels, an amount more than one-third greater than the former. Of stalks, one yielded 1.28 tons to the acre; another 2.40 ton, or nearly twice as much as the other. On the other plats of the two acres which were manured exactly alike and treated in the same manner, there was a like variation in the crops.

Now when we have conditions that apparently ought to give the same results, and which in ordinary experimenting would be assumed as giving the same results—when we find such conditions giving us a variation of more than 50 per cent.—the difference between fortune and bankruptcy—we see what careful experiments we must have to secure the *conditions* of experiments that can be relied upon in practical agriculture.

Another field was selected and divided into twenty-four plats (two by four rods each). With a single unimportant exception, he says, "*it would be difficult to find a piece of ground presenting a greater uniformity in the appearance of its subdivisions.*" The plats were all treated in the same way, the same amount of work was spent on each, the corn was all cut the same day, husked the same day, and weighed the same day. One plat

yielded 27.35 bushels; while another yielded 63.85 bushels, or more than twice as much as the first. The yield of stalks on different plats varied one-half. It is not strange that Professor Miles closes his account by saying: "From the wide range of variation of these plats, all treated in the same way, it will be seen that the results of a single field experiment in the application of manure cannot be relied upon to establish any rule of practice." "Improvements in agriculture can only be made by means of a systematic series of experiments, so conducted as to guard against all sources of fallacy, and then carefully repeated under a variety of circumstances."

I might add that similar results have been reached on our experimental farm connected with the University of Wisconsin. In experiments on potatoes cultivated exactly alike, results apparently widely at variance with each other have been reached. Like conflicting results have been reached at Lansing in experiments in the feeding of animals, especially swine and sheep. The same feeding would cause one animal to gain and another to lose, when no assignable cause for the difference could be discovered. Among the sheep there was a loss of weight in all the pens one week, for which the Professor adds, "The only cause that could be assigned was the change of management of other sheep in the same building." The sheep not under experiment were turned out by day and returned to the barn at night, and this so disturbed the experimental sheep that there was a general loss of weight among them, although the ration of food was increased.

We give the Professor's conclusion in his own language, which we consider well established by all these experiments as well as by the many others that have misled those that trusted to them. "It is exceedingly difficult to conduct any kind of experiment in practical agriculture in a satisfactory manner, from the great variety of circumstances that tend to modify results; but when the subtle principle of life as exhibited in animated beings is involved in the line of investigation, the difficulties in the way of exact determination seem almost insuperable." Is experimenting, then, in agriculture, a hopeless undertaking? By no means. The facts already cited only show the great difficulty of the work, or rather the careful training the experimenter must have to make his work of any value. Time and care will

reach the truth, though a single experiment may lead to entirely erroneous results.

But these experiments ought to convince us that much of what we now rely upon as agricultural experiments made to establish special points as to manures, seeding, and feeding of stock, is of little worth, because tinctured with error, and because the records of the experiments are so defective that the shrewdest interpreter of facts can seldom find means for detecting and eliminating the errors.

These results also show us that it is only by a series of experiments of the same kind repeated year after year, at the same place and by the same trained observers, that we can hope to secure data for trustworthy generalizations in agricultural science.

It would seem that common sense would teach any man that it would be the best and cheapest method, if not one absolutely essential, for reaching correct results, to have some place in every State where such experimenting can be done in the best manner. This is just the want which our Agricultural Colleges are fitted to supply. They can do this work for every State. They can send forth men trained to observe, and with knowledge enough of the difficulties in the way to save themselves and their neighbors from the necessity of making experiments as useless from their want of relation to others, as it would be to test the temperature of Pittsfield in January, to learn whether Indian corn would ripen there in September.

There is in agriculture a sound layer of practical knowledge, the common property of those best acquainted with the subject, and on many points where the conditions are few, much advance has been made within a few years. But the advance has been more in horticulture than in agriculture, and in both of them the advance has been more in improving kinds by selection than in any other way. This principle of selection is now well understood, and in the hands of skilful florists, pomologists and breeders, it has accomplished great results in securing improved forms of fruits and animals. Advance has been made in particular localities in regard to certain crops, and in those places men believe that certain principles are established, and so they are for them. But let them go to Wisconsin, or New Mexico, or California, and perchance these same men will utterly fail in

producing the same crops until they learn the influence of new conditions, and learn, perhaps, to change, if not to reverse, their New England agricultural customs. After we have gathered up all that can be relied upon in the common experience of farmers, and in the special advances that have been made in certain localities, and in the general cultivation of certain crops, there still remains a vast number of questions of the highest importance in successful farming which our best agriculturists cannot answer, or if answers are given, there is good authority on both sides.

On every side we see evidence that the progress of scientific agriculture demands observers and interpreters of observations. To secure these should be the first aim of our Agricultural Colleges. I know of no field of observation more difficult, and calling for higher training, than that of the scientific farmer, who is to observe every condition of soil, of climate, of vegetable growth and animal life. He must be prepared to throw aside much that has been done as rubbish. And when experiments are offered for his consideration, he must have the ability to judge of their truthfulness by the best tests, and then he must also be able to judge of their applicability to every given case. Every farm offers some peculiar conditions, and the scientific farmer must not expect to work by any rule except the one he forms for himself in the study of the land he is called upon to cultivate. I mean by this that almost every rule in agriculture depends upon conditions, which may vary greatly even in the same field. The knowledge must be in the farmer and not in books. And the knowledge in him must not be *from books* alone. He must have knowledge, but with it such power of observation as will make him master of every situation.

There is a sense then, in which we join the cry against "book farmers." It is undoubtedly true that those who farm by books without practical knowledge to judge of the applicability of the experiments or directions recorded to the case in hand, or perchance following some grand experiment which in its omissions, is like the play of Hamlet with Hamlet left out—it is undoubtedly true that such farmers come to grief, or would come to it, were it not for some good salary as editor, lawyer or minister, which enables them to call themselves farmers. The name of farmer is an honorable one, and many men in high positions

pay roundly for the name, and for the pleasures which the farm affords.

Clearly, one of the greatest obstacles to the progress of scientific agriculture has in time past been, that we have had no adequate provision for raising up competent observers in this industrial pursuit; and secondly, that we had no permanent system of experimenting, no places in different parts of the country where men could act in unison, and with means to carry on experiments from year to year, until reliable results were reached. Now all this ought to be changed, since every State has the means from Congress of establishing schools for the express purpose of conducting experiments under the best possible conditions, and of educating competent observers.

Now, however, new obstacles arise. In the first place, there is danger that the colleges will mistake their true work; and in the second place, that there will be on the part of the community an impatience to see results at once which can only be reached as the fruit of years of patient labor. On the first of these points, the mistakes of the colleges in the nature of their work, it becomes us to speak with great caution. But we hold some things to be self-evident in this matter.

First, it is the duty of these colleges to increase the sum of scientific knowledge in agriculture, and not merely to be retailers of the imperfect materials already at hand. It is their first business then, to enter upon a system of accurate experiments not only to establish results for their respective States or localities, but to do this in such concert with each other that the same experiments may be repeated for a series of years in each one of them, that we may learn what are the best conditions of growth for every important plant as well as the disturbing agencies in each locality.

To do this work properly, the first requisite would seem to be an experimental farm for each college. For it is on the farm that the final work is to be done. We may reach certain results in the laboratory, and some experiments in horticulture can be carried on even in a city garden; but those experiments in agriculture will alone be worthy of our confidence that have been brought to the test of farm work for the production of bread and meat.

Among the obstacles in the way of that progress which we ought to make, will be the failure of many colleges to enter vigorously upon these farm experiments, and the failure of those who do experiment to act in concert with others in carrying on the same series of experiments. Although the law of vegetable growth must be the same in all places, very few are aware of the different treatment which the same plant demands in different parts of our country, to insure its greatest perfection. And oftentimes the treatment which a plant demands in one place is taken as a rule for that plant wherever it will grow at all. A series of experiments conducted in the same way on the same plants in Massachusetts, in Michigan, in Wisconsin, in California, in Texas, Kansas and Georgia, would give us a new revelation of the work before us, to secure the means for progress in general knowledge for the world at large, while we learn the best methods of cultivation for our separate localities.

What measures can be taken to secure such unity of action, that every experiment may have its greatest value by being brought into comparison with the greatest number of similar experiments bearing upon the solution of the same problem?

Another difficulty will arise from the unwillingness of young men to take that long and vigorous course of study in natural history, mathematics and logic which shall make them competent observers and safe interpreters of facts. They will not believe that so plain a business as farming can call for such long continued and accurate study. Their friends will not believe it because they cannot understand the difficulties to be encountered. The community at large call for the "practical." And by the "practical" is often meant learning only what is well established. But that region where science is growing is called the land of theory and nonsense. Such practical men would leave the world forever where it is now. And it is almost impossible to get young men beyond their influence into a healthy scientific atmosphere. And when you have caught a few and prepared them for their work, another trouble meets you at once. These men are in such demand in other pursuits, that few of them will give themselves at once to farming. Now the colleges which are our hope for scientific progress in agriculture will have such obstacles in their way. And the danger is that before they show their real worth, they will be underrated and cramped for

means, and thus fail of success, because they lack the conditions of success. But the work is before us and enough has been done to greatly encourage us. Seeing these obstacles in our way, we are not to hesitate, but only to meet them wisely. It is the business of all who believe in scientific agriculture to secure in their own State the best conditions for its progress, and to labor especially to convince the young men of our time of the study they must give to this subject, if they would become worthy of the name of scientific farmers. I hope to see the day when some of the best scientific observers, the best educated men in all respects in Massachusetts and Wisconsin, will be found on farms.

And now, gentlemen of the Board of Agriculture, I can but congratulate you that you have done so much to promote the progress of agriculture in the past. Some of you have gained a wide renown for the improvements you have secured. You know well the time, the thought, the care such improvements cost. You know how futile it is for a man without training and without the means and time at his command to enter upon any course of experiments with any hope of reaching results that can be relied upon. We have too many carelessly conducted experiments recorded already. Knowing all this and having in my opinion better conditions for securing the rapid progress of scientific agriculture than any other body of men in this country, it is my hope and expectation that the Massachusetts Board of Agriculture and the Massachusetts Agricultural College will overcome every obstacle in their way and go on with renewed energy in the good work in which they are engaged.

Massachusetts cannot produce such fields of wheat and corn as are found in the great West, of which we all boast; but the soil of Massachusetts gives a generous return for good cultivation, and the high prices which her products command at home encourage the farmer to seek for every improvement. It pays for him to apply science to the farm. Let Massachusetts then hold the same proud position among those who are now engaging in this onward movement in agricultural science that she ever has held in all that relates to learning and the best interests of the human family.

SECOND DAY.

The Board met at 10 o'clock, and Col. STONE, of Dedham, was elected President for the day.

A lecture was delivered by the Secretary of the Board on "Dairy Farming," with especial reference to the secretory and reproductive organs of the cow. The lecture was illustrated by carefully prepared diagrams, and apparently gave very great and general satisfaction.

The discussion of "Dairy Stock" was then opened by

Dr. LORING. *Mr. President and Gentlemen*,—I find it announced on the programme, unfortunately for me, that the discussion on Dairy Stock is to be opened this morning by me, at the close of Mr. Flint's lecture. I have listened to this lecture with great pleasure and profit, as you have, and only regret that I am standing in his place.

I am glad that the subject is announced as it is—not a discussion upon Cattle Husbandry, but upon Dairy Stock. It is a bad thing to give the human mind a wrench, a sudden twist; it hurts the audience; it hurts the speaker. He is engaged in bad business. I had a friend once who had but one story, which was about a gun, and wherever he went, he was bound to tell his story. Whether it was a tea-party, a sewing-circle or a conference meeting, it made no difference; the gun story must come in, somehow or other; he had nothing else to say. Let there come the slightest lull in the conversation, and out he would break: "Hark! I thought I heard a gun. By the way, speaking of guns, reminds me of a story;" and then the company got it. The difficulty with my friend's story was, that he never introduced it in the right place. He always wrenched the audience—gave them a sudden twist—and they wished my friend and his story were out of the way. I am fortunate in being able, under the programme, to follow in the train of argument pursued by Mr. Flint.

Dairy stock! I suspect the mind of every man in this audience is filled with ideas of dairy stock by this time—the placenta, the uterus, the ovaries, the udder, the teats, and the way to get the teats open when they are too tight—and all that; we are saturated with the fundamental principles of dairy stock. So I can keep right on in that channel with perfect propriety,

and make that the foundation of the business of discussing cattle husbandry.

Now, my friends, it is not only the tendency of Mr. Flint's lecture that should satisfy the minds of us all of the importance of dairy stock, but it is the actual condition of dairy stock in the Commonwealth of Massachusetts, and the relations that it holds to the agriculture of this State. Among the animals of this Commonwealth, cows predominate largely. We have 90,000 horses, worth, it is said, nine millions of dollars; we have 50,000 oxen and steers; we have 175,000 cows and heifers; indicating that the business of cattle husbandry in the State of Massachusetts is dairy stock and dairy farming. I wish I could tell a better story with regard to the condition of dairy farming here. I do not know why it is, but, notwithstanding the fact that at last butter and cheese have entered into the exports of this country, and are engaged, with all other agricultural products—cotton, corn, beef, pork and lard—in establishing the balance of trade abroad, largely to the advantage of the financial condition of this country ultimately; notwithstanding we exported from this country $303,305 worth of butter in the nine months ending July 31, 1869, and $3,000,000 worth of cheese; notwithstanding all that, and notwithstanding the fact that nearly two million dollars' worth of milk are sold in the State of Massachusetts every year, and vast quantities of butter and cheese are manufactured and sold here, and it has become manifest that in some way or other the production of milk lies at the foundation of the great agricultural interest in a vast section of this country, cows do not materially increase in number. In 1855, how many thousand cows do you suppose we had? We had, according to the returns, 149,000 cows, and 28,000 or 30,000 heifers. We had in 1865, how many? I told you 175,000 cows and heifers, and out of that number only 150,000 were cows. While the demand for butter and cheese and milk is increasing, while the consumption of milk increases, with a manifest interest to have cows increase, they do not increase. There is some difficulty here. The channels of trade always run where profits are to be made. That there is a profit in butter farming, there cannot be the slightest doubt. I told you that while the demand for milk and the consumption of milk increase, the cows do not increase. Somehow and in some way

the supply of milk in the Commonwealth of Massachusetts is got from some other source than cows. It is found much more profitable, my friends, to run something else than a cow.

Why this is, it is difficult for me to tell. We have a good dairy section here; we have plenty of good pastures, and ought to have an abundance of food; but I am satisfied that the trouble lies in the fact that we do not understand yet the most systematic and economical way of producing milk, butter and cheese. We are laboring under a difficulty still. We have done a great deal, I agree; we have progressed vastly in the business of cattle husbandry. Cattle breeding—the bringing of an animal up to the wants and necessities of man—constitutes one of the most interesting chapters in agricultural history. The ingenuity of men like the Collings and others in England, in bringing a cow up to the wants and necessities of man, is one of the most remarkable exhibitions of agricultural care and skill. That plan by which the Shorthorn was produced; that plan by which the Merino sheep was produced; that plan by which the Devon has been brought forth, and by which man is enabled to bring about a condition of the animal economy suited to the most economical production of beef or milk, is really a great triumph of human skill in the business of agriculture.

Now we want to apply that skill to our dairy farming. We have gone on very rapidly in this business, but not rapidly enough; and we do not understand it sufficiently, I am satisfied, here in this country to make a practical application of it. We have created, as I have said, beef animals. I suppose that a pound of beef can be made out of a well-bred, systematically produced Shorthorn steer more cheaply than by any other animal in the world. I have no doubt, my friends, that a quart of milk can be better produced by a systematically arranged cow, of proper proportions, of a proper physical constitution, than by any other animal on the face of the earth; and when I tell you that by the skill of dairy farmers in the operation of breeding—that ill-shaped udder has been transformed into something so fair, so symmetrical, that the eye of an artist would be glad to look at it, and that cluster of teats—two long ones in front and two short ones behind—has been discarded, and that great hanging udder, dragging on the ground, has been tucked up

where it should be, and all the apparatus for producing milk has been so arranged in this animal that all that flabby texture that comes with ill-bred animal structure is replaced by something that stays where you leave it—when I give you to understand that, you will see that in this business of manufacturing milk human skill has also met with a triumph.

We are not increasing our cows, as I told you, as we should, for the reason, I think, that we have not yet found out what is the most economical cow, and too many of us are feeding cows at a loss. Is there any doubt about it? I suppose that more food is wasted in the Commonwealth of Massachusetts annually —not thrown under the feet of cattle, not thrown in the manure heap, not burned up or thrown away, but wasted in improvident feeding—than is annually used profitably and systematically in good feeding. Am I wrong in saying that more food is put into the mouths of inappropriate animals than is put into appropriate animals' mouths, and that more than three-quarters of the cattle of Massachusetts are fed at a loss, because they are not adapted to the purposes for which they are fed? I believe every farmer will agree with me. Hence our disappointment. Our cattle come out in the spring not in such a condition as we anticipated, because they are not adapted for what we intended them. We do not properly select our cows. We feed cows too large or too small for the purpose for which we intend them. What we want is a fair, medium-sized cow for the dairy. We do not want too large a one. We want a medium-sized cow—a cow that will thrive when she is dry, and which does not require a mouthful of grain until she comes to do service again. You cannot afford to raise grain for dry cows; you cannot afford to buy it. What we want is a cow which, when she dries up, is in a good condition, has not been exhausted in the process of milking, and when you give her a little rest in the barn, will begin to improve and come up again, well and strong, to this great business of parturition and giving milk. That is what we demand. So we need in this climate a medium-sized cow; not too large; not too coarse; not too thin nor too fine; compact; firmly set upon her legs; lively countenance; a good straight back. Mr. Flint said well, when he said, you do not want a drooping rump. It is not good for the cow, it is not good for the owner when he milks her, and it is not good for the man

who eats the steaks that come out of her; it is bad all round. The best animal to feed is one with a clean, well-shaped head, a luxurious mouth, loose shoulder, straight quarter, broad back and great depth of carcase. The tail should be long and the rump level.

Now go with me to one of the best dairy regions in the Commonwealth of Massachusetts—one of the best, so far as skill is concerned, in this country. I think, with all due respect to the gentlemen who are at work in that section, that the cattle they are feeding are too large and heavy. There is a little too much bone about them; they are too coarse; and so, as I have had the pleasure of going through their stables several times, I found that those stately cows, in March, looked as if the winter had not exactly agreed with them. They are too large for cold weather. Strength of constitution does not always go with size. There is too much bone about them. Muscle should always preponderate. In northern latitudes a man wants a little more cellular tissue and muscle than bone in order to keep warm. So it is with cows. These large animals, notwithstanding they had had a little meal, or perhaps a good deal, to help them along, did not look exactly as they should; they were not quite satisfactory. But among these animals would be a medium-sized cow, that had got through the winter pretty well, and did not require any meal to keep her going. Give her a little meadow hay at night, and a good quantity of English hay in the daytime, and she would carry herself along pretty well. So I argue, from that observation, that the best way for us is to bring cattle within the limits of our soil and climate and the feed that has been provided for us. We know perfectly well that a pound of meal put into the mouth of one animal will do more to improve that animal than a pound of meal will do for another; and knowing this, we can judge for ourselves what it is best for us to do in regard to this whole system of feeding.

I have told you that we ought to engage in the business not only of feeding dairy stock but of raising them. We ought to have an annual increase of the number of cows as well as of the amount of milk. We ought to have 300,000 cows in Massachusetts to-day. There is profit enough in the business, and if we had 300,000 cows we should have just twice the amount of manure we have. I think the fields would smile a little.

The old French proverb, "No cattle, no farming; few cattle, poor farming; many cattle, good farming," applies here. We need to increase the number of our cows, and find out how we can best produce milk to a profit, in order that farmers may derive the largest profit from their farms.

We want not only to increase our cows, but to learn how to feed them in their youth and maturity. That is a very important part of the whole business. Mr. Flint has shown you, with a great deal of skill and a great deal of exactness, what a delicate and intricate process the manufacture of milk is. I was very glad to hear it put in so elaborate a form, because I have so often alluded to it that I have thought sometimes my agricultural friends might think it was a hobby of mine, and that it was just as easy for a cow to make milk as for a steer to take on fat; but it is not. The business of making beef is an easy thing. It arises from the inheritance of physical qualities which are crude and rough when compared with this delicate mechanism which the cow has for making milk. So, from the beginning of calfhood, you must be careful how you feed the animal, or before she has half arrived at the condition of giving milk she may be utterly ruined.

Now, then, what would you do with a calf that you intended to rear as a heifer? If you have got a Shorthorn calf you would keep it on the cow; let it have all the milk that a Shorthorn cow would give; that won't hurt any calf! Keep it round; keep it fat; keep it looking well. I am talking now about the modern improved Shorthorn, meant for beef. The old-fashioned Durham stock I have a good deal of respect for. They were good square-hipped profitable old cows. But keep the modern Shorthorn growing. If his leg is a little large below the knee, it does him no harm. If his carcase is overloaded with fat, it is all the better; he takes the more premiums. If he looks rugged and strong, it is what you want. He is made for beef; he is a beef calf, and the larger he is the better. You may give him oil-cake before he leaves his mother, and after he leaves her you may put him into a clover field up to his eyes, and keep him growing, and your object is accomplished.

But if you have a heifer calf to rear, and you keep her with her mother until she is three months old, you will find that you have developed every conceivable quality opposed to the produc-

tion of milk. You will make the bone too large, the carcase too round. You will contract the abdomen of the cow, in which all those organs are laid that go to fill its udder with milk. You will make her too delicate, too dependent upon nice food; and, more than all that, you may create in the calf a tendency to inflammation of the glands connected with this intricate and delicate system which you have heard described. I have no doubt that the seeds of garget and inflammation of the udder are sown for the cow during her period of calfhood. So I would take the heifer calf from the cow early; bring it up by hand; put it into the shape of a little cow as early as possible; do not let it look pinched at all, but keep it thriving. Feed it on grass cut for the purpose; give it turnips and oatmeal. The best thing in the world to make bone is Swedish turnips. Get your calf, I repeat, into the shape of a miniature cow as early as possible, and keep it along in that line, and you are developing the qualities that will make a cow when it shall have arrived at its full growth. There is no danger of its having derived, from feeding, those diseases of the udder that will make it utterly useless, nor any danger that it has developed any other animal organ except those which you want for your purpose when you get your cow.

When the calf is grown, what then? Why, the same rule of feeding adopted when it was a calf, adopt when it is a cow. I have heard a great many say, "You can feed cows on cornmeal and cotton-seed meal and oil-cake with impunity; feed them heavily; it won't hurt them; they can stand it." It is an entire mistake. The dairy cow is a delicate animal. You must remember that a good cow matures slowly. It is not at two years old, nor three years old, nor four years old, that a good cow comes to perfection, any more than it is at three or four years old that a good horse comes to perfection. The development of a dairy cow and a horse are identical. It is a slow process, and you must keep your cow gradually growing up to that point where she arrives at her perfection; and, in order to do that, you must feed her as I have suggested in regard to the calf.

I always insist upon it, that the natural food of cows, in the first place, is grass. You may talk about soiling cows. They will get along on grass and grain and clover and green fodder,

green corn, the meanest and cheapest of all things that a farmer ever raised to feed to a cow; but the farmer who is making milk, and undertaking to bring up his cows upon anything but pasture, is constantly working up hill.

Now in winter we want something as near pasture grass as we can find. Early cut hay, or rowen hay, with a supply of mangel-wurzel if she is giving milk, or Swedish turnips if she is dry, to keep her in good condition. It is an economical way to feed. If you must give her any grain, give her shorts, or even a little oat-meal, but do not resort to corn-meal, or cotton-seed meal, or oil-cake, for dairy cows. There has been a little controversy about this matter. But I have learned from experience that the feeding of oleaginous matters to dairy cows is injurious to them. Four or five years ago I undertook to feed forty or fifty cows that were in milk, in the winter season, upon two quarts of cotton-seed meal a day and two quarts of shorts. They had what hay they wanted, and about a peck and a half of mangel-wurzel. I thought it was good food for them. Three years of that kind of feeding destroyed thirty of those fifty cows.

QUESTION. What kind were they?

DR. LORING. Good cows.

QUESTION. I mean what breed?

DR. LORING. They were Ayrshires. You cannot use an Ayrshire up easily. They will stand pretty much anything. Their udders are made, you know, for work, and they are not to be broken down by a trifle. But I found the udders of those cows had all got out of condition. One teat would go, then another, and at last I had cows with two teats, cows with one teat, and the value of my herd was gone. I could not do much with them. They lost their appetites, and it was evident enough that those animals had been fed upon something that did not agree with them, and that their lacteal system had been ruined. This little delicate organism had been inflamed, was broken up, and was good for nothing. I supposed it was the cotton-seed meal. I took it for granted it was, and said so. I was told that I was mistaken. Three years ago I purchased in the autumn six cows from Vermont, and put them on cotton-seed meal for a purpose. The cows had calved in the autumn. They were put into the barn, intended to be run for milk until

spring, and then sold for beef. They went on very well, and looked well when spring came. They answered for cheap beef well enough. One I thought I would keep. She had given seventeen quarts a day on this feed. She was a great strong Vermont native cow. I turned her into the pasture in the latter part of June when she went dry. She did not improve at all. She looked sorry, disheartened. She looked as if the grass did not agree with her. I put her into another pasture, and that did not seem to do her any good. Then I undertook to soil her, but to no purpose. She came in again in the fall, but instead of giving seventeen quarts a day, she gave seven, and it was evident that her whole constitution had been destroyed by a single season of feeding on cotton-seed meal. That has proved to my mind that I was right when I inferred that I lost twenty-five or thirty cows when I fed cotton-seed meal; and I laid down this rule—that the nearer you can get to pasture grass for feeding dairy cows, the better. Good water, good light, early-cut hay, roots and shorts, are sufficient for any cow. It is the cheapest food you can get. I do not wonder that the State of Massachusetts, feeding corn-meal to her cows, does not increase their number. There is no reason why farmers should increase them, if they have either got to raise corn on these hills or buy it in the market. I do not wonder that the dairy business of the State of Massachusetts does not increase, when so many men will not learn that the feeding of corn-meal to dry cows or dairy cows is an unprofitable business, and that cotton-seed is destructive.

Now I desire to say one or two words with regard to the feeding of cows in the autumn, between the time of pasture-grass and winter. Everybody knows that is a difficult spot to get over. The best farmers know it—the best feeders know it. From the middle of September until the middle of November, how are you going to feed your cows? It is a difficult thing to do. Your pastures are dry. You cannot profitably begin to feed hay in the middle of September. What are you going to do between the middle of September and the middle of November? You cannot raise green crops in those two months with any profit. Suppose you have a lot of beef cattle that you have not turned yet. You must carry them through those two months, and how are you going to do it? Will you feed them

on corn-fodder and cabbage-leaves? Will you turn them into fall feed? Will you put them on mowing lands? Will you feed them in the fields, or will you not? This, my friends, is a pretty important question. I will acknowledge that it is an open question—this question of fall feed for dairy or any other stock. I am going to tell my own experience again, and any other man may tell his. I suppose many of you are situated just exactly as I am. I have a large farm,—about five hundred acres of land,—and I desire to make it as profitable as possible. Now, from the middle of September until the middle of November, I have forty cows generally at work, producing one of the great staples of the farm. What can I do? I have a cabbage field, from which I sold, during the summer months, perhaps a few thousand heads, and the leaves are left. Would you depend upon them? I think not, if there is any fall work to do. You cannot feed them on Swedish turnips then. It is not good economy to use your hay-mow in the middle of September. What will you do? There is a field covered with rowen—half a ton of grass, or maybe less. There is a good chance for your cows. Forty-five cows ought to earn, anywhere near a good milk market, from fifteen to twenty dollars a day, if they are in good condition. It is undoubtedly profitable to feed your mowing lands in this state of affairs. I agree that the crop next year will be reduced, unless you cultivate your grass land. It must be laid down as a rule, that the cultivation of grass is like the cultivation of potatoes, or rye, or barley, or any other crop. After having cropped to their utmost capacity the mowing lands, cultivate those lands, as you do corn and grain lands. That is the rule which I have adopted, and I cannot afford to adopt any other; and, my friends, I have begun to think that the wholesale statement that cattle should never be fed upon mowing lands is simply an encouragement to second-rate farming. I may be mistaken; I may be wrong about it; but I desire gentlemen to think of it one moment, and consider whether they had not better adopt this method of feeding their cattle, with the expectation that they have got to cultivate so much more land, always remembering that it is no use to feed a profitless animal, whether in the pasture, in the barn or in the hay field.

That is my theory in regard to feeding grass lands, and I think it is as much a part of the management and carrying on

of dairy stock as any other part of the business of feeding that is known to the farmer. I offer these suggestions, in a hasty way, with the most entire confidence in your good judgment, and with a desire to learn of you. I only state these things for your discussion. I was called upon to open the debate; I have endeavored to do so; and now I trust there is some one ready to controvert the statements I have made, if there is really any reason for their being controverted.

The PRESIDENT. I have been requested to call upon Mr. T. S. Gold, the Secretary of the Board of Agriculture of Connecticut.

Mr. GOLD. No one could be more surprised than myself that I should be called upon at this time to address this audience; but the subject of dairy farming, and the vast interests connected with it, have been so strongly impressed upon my mind, that, even without any premeditation or thought at all that I should be called upon here, I cannot fail to embrace this opportunity to say a few words at this time.

I most heartily concur in many of the points which Dr. Loring has made upon the subject of the class of cattle that we need for dairy purposes. I believe, with him, that there are families of the Durham or Shorthorn stock that are admirably adapted to the needs of the dairy. We have the fullest evidence before us that in the valley of the Connecticut, and some other sections of our country, there are strains of blood of this class of cattle that are unsurpassed for dairy stock. We have farmers there of the greatest sagacity and skill in breeding, who claim, and we believe with justice, that they can make more milk out of that class of stock than any other upon their rich and abundant pastures. But, on the other hand, we have other sections of Connecticut and Massachusetts where our hilly lands and more scanty pastures demand a different class of stock. We have men who have thoroughly examined this subject, who have tried the different classes of cattle, and who have come to the conclusion, as the result of their experience, that a smaller animal is better adapted to their wants. I heartily concur in the points made by Dr. Loring in that particular.

In regard to the last point upon which he spoke, whether we shall turn the cattle into our meadows in the autumn, I will say, that in the section where I belong we are decidedly in favor,

from our experience, of the system of feeding our meadows. If the meadow is kept in good heart by suitable top-dressing, we consider that a fair degree of pasturing in the autumn improves the chances of a good crop the next year. It is almost the universal practice with us to pasture; and wherever, in exceptional cases, we have neglected to do so, or have removed only a portion of the rowen crop, we have failed to observe any advantage the next season. In two orchards of young trees I mowed a strip between the trees with my mowing-machine, leaving six or eight feet unmowed and unpastured, except by a small flock of sheep. There was a large growth of after-math upon it. The succeeding season I watched closely to see if there was any difference where the mowing-machine had run in taking off the after-math. One of the fields was orchard grass and clover principally; the other was old turf of the finer grasses. I was unable to discover, in either case, any advantage in favor of the part on which the rowen was left. So I have left some fields without feeding entirely, and the smothering of the grass from the fine grass left upon the surface has led me to the conclusion that it is not a wrong principle, in our section, to feed our meadows during the months of September and November.

Mr. Goodman. I rise, gentlemen, because I could not help rising after hearing my friend Dr. Loring. The doctor's gun always goes off so easily, that I feel a good deal as the man did out West, who, on entering a town, heard half a dozen bullets whistling around his head. He turned round, and the man who was firing at him, recognizing his face, said: "I beg pardon; I thought it was another man." When I am in company with my friends Dr. Loring and Mr. Birnie, and these other Ayrshire men around me, I feel that I am in danger of being annihilated; and their doctrines come so near the truth, that unless a man is very radical he is in danger of being converted; and I do not know but a great many people would be better off to be converted to the Ayrshire doctrine, than to continue in the belief of the doctrines they now cherish. But I am engaged in a very different business from that of breeding Ayrshires. I am engaged in the breeding of Shorthorns and Jerseys. When I look around upon the dairy stock of the country, as a mere matter of profit, I do not see any better class of cows than the

ordinary native cows of New England; and if I were to-day getting up a herd of cows merely for the purpose of producing butter or milk, calculating the cost of those animals, and what they would give the year round, I apprehend I might go further and fare a great deal worse than to select fine animals from our native stock. But, gentlemen, the great difficulty about our native stock is that there is no confidence to be placed in their offspring. You can have no certainty that the children of these dams will equal in any respect the dams themselves; and therefore, in a few years, if that system should be kept up, we should run out of good animals. We cannot continue to have good animals in the country unless we replace them by cows from imported stock.

In this section of the State, our habits, following our interests, are a little different from those of farmers in the other parts of the State, where the doctor and our other friends are living. We have not, until lately, bred cows for the purpose only of producing milk. That is a business into which only a portion of the inhabitants of Berkshire have entered. The milk that goes down the Housatonic Railroad to New York is received with as much favor as the milk from any other part of the country, if not more; and our farmers, from Lanesborough all down the Housatonic Valley, are finding it one of the most profitable employments in which they can engage; and farmers who want to engage in that branch of business cannot do better than have the class of cows to which my friend Loring referred. I apprehend there is no better class of cows than those that have an infusion of Ayrshire blood in them for producing milk. But some of us are so situated, either from the condition of our farms, or from being occupied with business outside the matter of farming, that we want to carry it on so as not to be driven to the necessity of transporting our milk to the depot every day. Therefore we are engaged in the production of butter and beef; and I apprehend, with all due deference to these gentlemen, that we cannot get from Ayrshire cows as good quality of butter as from half-breed Durhams, or as we can from our Jerseys; and therefore we find upon the hills of Berkshire that the most profitable animals we can breed are the Shorthorns, or their progeny, or other half-breeds, the progeny of native cows, mated with a thoroughbred Durham bull. We find this profitable,

because, in the first place, they give us a good quality of butter; and, in the next place, they fat easily, and we have no sharp creatures to turn off every two or three years, when it is necessary to eliminate them from our herds.

Now as to this question of feeding. It is very difficult to controvert the statements of my friend the doctor, especially when he alludes to his experiments; but he was not here last evening to hear the remarks of Prof. Chadbourne upon the worthlessness of experiments unless conducted on a large scale and with great accuracy. It is very difficult to arrive at a correct conclusion, when we have the testimony of Dr. Loring on one side, and on the other the testimony of farmers all up and down the Connecticut Valley, who feed cotton-seed meal all through the winter. We have got to take these opinions and experiment for ourselves, and judge accordingly. I have fed cotton-seed meal to a considerable extent, and in one or two instances I thought my heifers were injured by it, and that may have been the case; but I have fed it very extensively to Durham bulls, and I have not found that they have been injured by it in any way. It may be, as the doctor says, that the delicate glands of the female are easily affected by rich oleaginous food like cotton-seed meal, whereas the system of the male, being more hardy, would not be injuriously affected. Therefore you want to use this feed with extreme caution.

Now as to this question of feeding. Those of us who are living among the hills of Berkshire find the remarks of the doctor diametrically opposed to the conclusions at which we have arrived. The idea of telling us that we cannot feed corn-fodder or corn-meal is like taking the very ground from under our feet. We are almost as much wedded to our corn-fields as we are to our wives, and when you undertake to tell us that we are not to give our animals the food which we consider a necessary part of their daily subsistence, it is pretty difficult to point out what we shall take in its place. We have thought that the greatest injury we can do to our mowing lands is to feed them off in the fall. All the best farmers have been trying to indoctrinate the agricultural community with the idea that we are ruining our farms by feeding off all this grassy matter in the fall, and leaving almost the bare ground to be exposed to the cold of winter. We have become satisfied, many of us, by

actual experiment, that that has been ruinous to our hay crop. But, after all, there is a maxim, *in medio tutissimus ibis*,—in the middle course there is more safety than in extremes,—and it may be that our fields would suffer no injury if fed off during a certain portion of the year, and the cattle not kept on them until the snow comes, so that they are gnawing down to the very roots of the grass. The difficulty is for the farmer to exercise the judgment in this mode of feeding that the occasion may require. When once he has got his cattle on the meadow, his indolence, and the desire to save his hay, combine to induce him to leave them there until they are driven by the bleak winds into the barn ; and the result is, that the timothy grass is gnawed down to the very roots, so that there is no vitality left in it the next spring to produce the hay crop which our meadows ought to yield. It may be possible, by an abundance of manure and very careful cultivation, to bring up our grass fields so that they will afford proper nourishment in the fall to our cattle ; but it does seem almost impossible to carry out that theory of feeding by which, for two months after the grass in our pastures is substantially gone, we are to feed our cattle on our meadows, and yet expect the next year to get a good crop of hay from those same meadows.

But, gentlemen, my experience has been, and I apprehend it has been the experience of a great many farmers, that there is a great deal of reliance to be placed on this corn-fodder which my friend the doctor so thoroughly anathematizes. The better class of our farmers about here have been raising this corn-fodder for several years, and I have never heard anything said against it until this season by Mr. Nicholson and Dr. Loring. Mr. Nicholson says that this corn-fodder, being grown so close and deprived of light and air, does not contain so much nourishment by half as ordinary corn ; and he seems to come to the same conclusion as Dr. Loring—that this corn-fodder is not worth raising. There you have an illustration of Prof. Chadbourne's doctrine again. These gentlemen have been experimenting ; but we have been experimenting here, and we find that for two months of the year there is nothing better to carry our cows through than this corn-fodder. Our way is to sow it broadcast, and just before the frost comes cut it down and let it dry for three or four days, as you do your hay ; then put it

up in small cocks, throw our hay-caps over it, and we can keep it there and feed it day by day, until winter drives the cattle into the barn. And that appears to me to be the real succedaneum, if any method could keep our cattle through the fall season; because, when we have got to house our cattle from October until nearly the first of June, it takes capacious barns, large farms and an immense deal of labor to procure hay enough for those animals; but by the use of corn-fodder,—feeding it out from the time it arrives at a proper growth, say the 8th of July, until the frosts are about falling, and then partially curing it in the manner I have described,—you have something by which your hay is saved; and my experience as a butter-maker is that I get better butter in the fall from that fodder than any other thing, except the earliest grass. But there is no doubt that the principle the doctor lays down is the true one—that grass is the natural food of the cow, and the nearer we can approach to this grass the better. The farmers are arriving at that conclusion, because they are arriving at this one point—that if they can commence cutting their hay the middle of June, and get it into the barn before the first of August, they are getting the hay that will best carry their cattle through the winter, and give them the best butter and milk. Therefore the great principle in our cattle breeding is to get the best crops of hay we can; and as we cannot continue our pasturing through the year, we want the best substitute we can get for that before we put them on hay.

Now in regard to these small animals the doctor speaks about, although he did not allude to them by name. My theory is somewhat different from his. I claim, with all due deference, that we have a perfect right to indulge in the luxury of raising Shorthorns, if we can afford to do it; and we want to engage in the luxury of raising Jerseys, because, as a mere butter machine, you cannot find anything equal to that cow upon the face of the earth; and, differing from the other animals,—the Ayrshire or Shorthorn,—the progeny of the Jersey is almost invariably as good as the dam. She is a great butter machine—a cow that will make a pound of butter to five quarts of milk; and we are getting cows in this country that will give now from fourteen to sixteen and twenty quarts of milk a day. These are going to be our great butter-makers; and when you can get an

infusion of that blood into our native stock, you will find that the progeny of these two are going to make something superior to anything we now have.

I apprehend, gentlemen, that there is no great difficulty in the way of our indulging in the luxury of raising Shorthorns upon our hills, or in any part of this State, because, in the first place, we are arriving at certain knowledge, in agriculture, which assists us in bringing our farms into better condition than ever before. All we have got to do is to recollect that we have got noble animals that are worth raising, and that we can afford to feed them. The best way to feed them is by enriching our farms, and getting them up to such a condition that they will support those animals. We do not want any farms round in Berkshire County—we have not got many—that will only support small animals. We have excellent soil for grass, and we can do nothing more profitable than to turn our cattle, our improved Shorthorns, in summer and in autumn, upon our pastures, even if those pastures are substantially meadows; and when they are eaten off, in two or three years, so that they would not cut more than a ton or a ton and a half to the acre, turn them up and reseed them, and keep them as you would meadows; then you will find that you are raising cattle profitably, because these improved Shorthorns, at two years old, are just as good, just as fit for the butcher, and bring a larger price than ordinary cows at four years old. That is the experience of England. A century ago, in England, the average age of steers brought to the market was four years. It took four years to grow them to a point at which they were fit to be brought to the shambles. Now, by the use of Shorthorn bulls, they bring an animal to the butcher at two years old, equal in every respect to those animals at four years old. You can calculate in one moment, considering the saving of two years' hay and meal, the great profit that that affords. That is what we want here. We want it for our dairies and all the purposes of the farm. If a man is running a dairy, let him get animals of this class, take them from good milking families, and when he wants to change, he can turn them over to the butcher in good condition in two or three years, and get others of the same class. I apprehend, if we set our minds upon getting these animals, or any other class of animals, it is not necessary to pay any attention to our

pastures, if we have got sufficient land out of which to make good pastures, by turning it into meadows.

Dr. Todd. I would like to ask a practical question. How can people who live in a village like this—and Massachusetts is full of them—keep cows? We want milk, and yet we have no pastures. We drive our cows a mile and a half or two miles to find a pasture, and then there are five cows on one pasture, however small. Is there any way in which people in a village of this size can keep a cow or two cows, and feed them through the summer, without destroying the animals, and have good milk?

Mr. Goodman. I suppose these substitutes for grass are not grass itself. You can't keep a cow in a city lot, of not more than a third of an acre, unless you have something to feed her upon.

Dr. Todd. Is there any substitute for grass?

Mr. Goodman. I don't suppose there is, but a cow will give milk of a good quality with ordinary hay and ordinary keeping. Cows are kept so in the city of New York on high rents, and there is no complaint of the quality of the milk, but the quantity is not so great.

Dr. Todd. Does not the animal suffer?

Mr. Goodman. I do not think the animal suffers. I had milk for a long time from a cow kept in a stable. She had her hay every day, and every morning or night, bran in warm water, and occasionally a little corn-meal. I don't suppose she would know what grass was, after having been there so long as she had been. But a much cheaper way in our villages would be to have a man bring milk round and sell it to your families, if you can find men honest enough not to water it too much.

Question. Have you any such men in Lenox?

Mr. Thompson. I will say that I have followed Dr. Loring's opinions for many years in regard to feeding dairy stock; I have drawn very many good conclusions from them, and adopted his suggestions in a great many ways. In regard to the profit or necessity of feeding cattle upon our mowed lands during the latter part of the season, I must say exactly as he does, that no farmer of small means on a small area of grass land can carry on his farming profitably without pasturing his mowed lands.

I will say, in answer to a question that was suggested some time ago, that I mowed my land this year, over peat bottoms, about the 20th of June, and I was very desirous of getting another crop, but my pastures failed, and after a good crop of rowen had grown, I considered the matter very carefully, in order to determine whether it would be more profitable to cut that grass or pasture it, and so retain a full flow of milk from my cows. I concluded to do the latter, and turned my cattle on to about ten acres that had been mowed as fast as we could gather the crop after the 30th of June. I pastured nine cows upon those ten acres up to the time that I was obliged to feed them from the mow, about the 20th of November, and they did not have a mouthful of grain from April until the time they went into the barn. My practice is to induce a flow of milk, after they leave the grass, with some sort of feed that will be as cheap as anything I can possibly feed them with. You can then begin to feed carrots and some shorts, for the grass is of very little use to make milk after the frost has struck it. My intention is to recover those fields by pasturing them, the coming year, all through the season; that is, to put the cows on as soon as the season gets well forward. I cannot plough those meadows that were mowed, because the soil underneath is too cold, with a peat bottom. I can pasture those lands two or three years, and bring other grasses into the mowing lands that I have been pasturing before. That gives the natural grasses an opportunity to come in, and if we do not pasture hard, they will come in better than they will if mown every year right through. Then, at the expiration of two years, I will manure those lands again, and bring the grass into mowing, with three tons to the acre, and so alternate, every two or three years. One acre of such pasture land will carry a cow right straight through up to the time she can gather the new grass grown on meadows that are mowed in June. A neighbor of mine has pastured twelve cows on eight acres adjoining mine and four acres in another locality, equally valuable, but not fit to cultivate with ploughed crops. He has pastured his cows up the middle of August, and then he has put them on three or four acres of land that was mowed about the 20th of June, until the pastures on those low meadows recovered, and then he has pastured upon them, alternating every two weeks or so. He pastures his cows in this

way through the whole season without any extra feed. He has never raised a hill of corn to feed to his stock since I have known him. He does not feed any meal or anything through the season until his roots are ready in the fall. Farmers with us must pasture their mowed lands, or they can never make farming a profitable business.

Adjourned to 2 o'clock.

AFTERNOON SESSION.

The Board met at the hour appointed, and took up the subject of

FRUIT CULTURE.

THE PRESIDENT. I have the pleasure of introducing to you the champion of Pomology in this country, the Hon. MARSHALL P. WILDER, who will give you a lecture on Fruits and their Cultivation.

Ladies and Gentlemen,—The culture of fruits, or in modern language, the science of pomology, occupies so broad a field of research, that anything like a thorough discussion would require more time than can be allotted to me on this occasion; but I am most happy to render any service that may be required of me by this Board.

The grain and vegetables of the earth may be considered as the substantials of life, but the fruits of the garden and the orchard I have ever viewed as the overflowings of God's bounty. Whether as a luxury, contributing to health and the gratification of the appetite, or as a profitable crop for the farmer, the subject, even here in Massachusetts, from whence primarily emanated the great interest in fruit culture which now has spread over so wide an extent of our country, does not receive the careful attention it demands. Great as is the fame of Massachusetts as the pioneer of American pomology, extensive as has been her influence in exciting a spirit of emulation in this branch of industry, splendid indeed as have been her acquisitions and exhibitions of fruit, yet it must be acknowledged that her soil and climate are not naturally the most propitious for the cultivation of fruits; but the energy, enterprise and indomitable perseverance of her sons, have surmounted many of the

natural obstacles, and she still maintains her high rank in this department of culture. But while we make these acknowledgments, we rejoice in the fact that no country, on the whole, is more favorable for fruit culture than our own. The fame of our apples in European markets is proverbial, and the day is not distant when with our California and the Western fruits, we shall, in addition to the enormous consumption at home, furnish large supplies not only to Europe, but to China and Japan, of the finest apples and pears in the world.

Formerly the cultivation of the finer fruits was confined to the gardens of the opulent, but the multiplied facilities for intercourse, and the emulation excited by exhibitions and conventions, has awakened an enterprise from the Lakes to the Gulf, from Alaska to Arizona. On both sides of the Rocky Mountains, orchards, gardens and vineyards are planted on the most extensive scale, and no sooner does the hardy pioneer open the way for the emigrant than these spring up as by magic, and the cry comes from one end of our land to the other, How shall we produce the most valuable fruits? What are the best methods of cultivation? What the most approved system for ripening and preserving our fruits? To gather up the lessons of the past, and to answer these inquiries, with especial reference to our own instruction, will be the object of my remarks.

One of the prevailing errors of the past has been that fruit, like forest trees, would take care of themselves; and it is this neglect which has entailed on us so many old, unproductive trees.

Most of the old orchards of New England have been planted without sufficient regard to location and proper preparation of the soil. Many of them are in grass, and the exhaustive process of gathering grass and apples from the same field, has, in a measure, depleted both. There is no such thing as inexhaustible fertility. Even the fertile soils of California, rivalling in the size, beauty and productiveness of her fruits those of any other part of the globe, will, in time, yield to the inexorable demand for restoration of the fertilizing ingredients which they are now so triumphantly bearing off in these beautiful productions of Pomona.

In our climate, fruit-trees require especial attention. They will not take care of themselves, and the cultivator must realize that without constant diligence he cannot expect success. Different varieties require different soils and different treatment. We must therefore study the constitution and character of each, if we would secure perfection.

The different ability of varieties to resist heat and cold and other meteorological agencies, reveals a most wonderful analogy between the vegetable and animal kingdoms; for while certain animals find their natural home in the frigid zones, others in the temperate, and still others in the torrid, there are some that are cosmopolitans. So with our fruits. Some are suited to one locality, some to another, and a very few to a great variety of latitudes. Upon the observation and study of these depends much of the success in fruit culture. Our soil and climate in Massachusetts is not naturally very propitious for the cultivation of the pear, yet there are numerous varieties which prosper as well as our forest-trees, and are as sure of a crop of fruit as the former are of nuts. The Bartlett pear-trees, originally brought from England more than sixty years since, still survive in Dorchester, (now Boston,) and have never failed to produce fruit annually. For more than twenty years the Beurré d'Anjou, Doyenné Boussock and Vicar of Winkfield pears have scarcely ever failed of giving a crop. Certain varieties are adapted to a wide extent of territory. The Red Astrachan apple and the Bartlett pear succeed throughout our country.

But we have special difficulty to contend with in our bleak winds of New England. In the early settlement of Massachusetts, and in most of our Eastern States, delicate fruits, such as the peach, apricot and plum, bore and ripened their fruit freely. Then these fruits were planted in gardens or sheltered locations, and in the openings or by the side of the woods, by which, immediately or at no remote distance, they were protected from the extremes of our climate, and the fierce dry winds to which they are now exposed. When, by degrees, this natural protection had been removed, the peach and some of our more delicate varieties of the apple, pear and other fruits, began to decline, and are no longer to be relied on; and yet these same fruits, in the middle and Southern States, succeed most perfectly; and so, in some of our new Western States and Territories,

these varieties prosper as well as when grown under glass. We have, however, some compensating advantages for this loss of forest protection in the ameliorating influences of climate exerted by the ocean or large bodies of water, like those of our Western lakes and rivers, which soften the temperature; and to this, in a great measure, perhaps, may be attributed the great success of grape culture in the West.

The non-adaptation of varieties and their deterioration are among the difficulties which we have to contend with. We should therefore resort to the production of new native sorts, upon which we may rely with more confidence; for, as a general law, it may be assumed that where nature has planted any of our wild species, whether fruit, forest-tree or vine, other and improved sorts may be raised by hybridization, either natural or artificial, which will be equally as well adapted to that territory. The grape, for instance, grows spontaneously throughout our territory, extending over twenty-five degrees of latitude, and in longitude from ocean to ocean; and from the process of cross-fertilization we are adding every year new and valuable sorts, either adapted to particular locations or to general cultivation.

There are, however, disappointments and vicissitudes. There are, indeed, mysteries which we do not at present understand, yet, far from abating, they should actually increase our ardor in the pursuit of knowledge, nor should we be blinded by the dreamy speculations and doubtful theories of those who always see a lion in the way. We are too often discouraged by the inconstancy of the seasons, but these are incident to all of our crops, and they will probably continue to exist. Cycles of favorable and unfavorable years have always existed both in this and other lands. While one section or country suffers with drought, another is almost submerged in water. Such was the case in 1867 and 1868, between the West and East,—the former parched with drought, the latter drenched with rain, thirteen and a half inches having fallen in September of the last year, against three and a half inches, the average amount per month for fifteen years; and this year the West is suffering with too much moisture, while New England has been blessed with a most propitious season, until the late terrific hurricane which swept the fruit from the trees on its eastern borders. Great

allowances should therefore be made for this fickleness of the seasons.

One word in regard to the importance of

THINNING OF FRUITS.

There is no branch of fruit culture which has been so much neglected as the proper thinning of the crop. Experience has taught us as one of the most important lessons in good cultivation, the necessity of thinning our fruits, in order to produce those of first quality, and that where trees are allowed to overbear, exhaustion and barrenness will certainly ensue.

The thinning of fruits, especially the apple, pear, peach, plum and grape, is indispensable for the production of large, fair and valuable fruits. The capability of all created things has a limit. If a tree or vine bear beyond its strength, its fruit will be injured, its growth retarded, its life shortened. Fruits that are properly thinned will command a much higher price and a more ready sale than those that are not thinned. One of our farmers, near Boston, always thins his fruit—another, adjoining his orchard, neglects it. The location and treatment of these two orchards in other respects are much the same, but the former realizes for his crop of Baldwin apples about four and a half dollars per barrel, while the latter, standing by his side in the market, receives less than three and a half dollars per barrel for his.

And so with the pear; while those properly thinned and cared for will command $4 per bushel, those of the common run will not command more than $2.50; and this rule applies not only to fruits, but to all vegetable productions. All have observed that the overbearing of a fruit-tree one year is likely to produce barrenness the next. Hence the necessity of thinning our fruits, so as to avoid exhaustion of the tree, and to keep up a regular succession of good fruit. Even our Baldwin apple, which from its great productiveness, bears only on alternate years, we think might, by thinning, be made to bear annual crops.

Where fruits are crowded, they are not only deprived of light, air and heat, but actually of room, so that the adjacent sides of two fruits are compressed and not fully developed. Not only the form, but the color is improved by thinning, and where fruits are crowded in clusters, they are more likely to be at-

tacked by insects and mildew; therefore the necessity, if we wish for perfect specimens, of removing a part, so that no fruit should touch another.

PRESERVATION AND RIPENING OF FRUITS.

In regard to the preservation and ripening of fruits, I can only allude to general principles, and confirm opinions expressed on former occasions.

The condition of the fruit, when gathered, is of the utmost consequence, and it is in vain to expect fruit which has been injured in picking to be preserved in good order. Whoever does expect bruised fruit to keep, will certainly be disappointed. As has been well stated by Mr. Manning, "The fruit must be carefully gathered perfectly dry, and must not be bruised nor chafed. The waxy secretion found on fruits, is a natural provision for the protection of the skin from the effects of moisture and air, and should not be removed even by wiping," for when the skin is deprived of this protection or is broken by pressure, the oxygen of the air comes in contact with the juices of the fruit, and fermentation and decay ensue.

Summer and early fall pears should be harvested as soon as they commence ripening on the tree, and should be placed in a dark, cool room until ready for use. This process serves to elaborate the juice and sugar, but if left on the tree until mature, most kinds will become mealy and fibrous. Not so with early apples; a contrary practice should be adopted with them; for instance, the early apples should be allowed to become perfectly ripe before being gathered. So well convinced of this fact are our best cultivators near Boston, that they mulch the ground under the trees with hay or straw, and allow such early varieties as the Early Harvest, Sweet Bough, Red Astrachan, Williams Favorite, and even Gravenstein to drop from the trees, and gather them daily.

With late varieties, both of the apple and pear, it is best to allow them to remain on the trees as long as possible without injury from frost and gales; but when the foliage has fallen, or is destroyed by frost, the functions of the tree are arrested and no further advantage to the fruit can be derived.

As the flavor of fruits is so very delicate, it is absolutely indispensable to keep it from all decaying substances, either its

own or other matter. The aroma of fruit, upon which depends so much of its relish and excellence, is extremely volatile, and the fruit should therefore be excluded from the air as much as possible, only admitting what may be necessary to preserve proper temperature, and the prevention of too much moisture. No imperfect specimen should therefore be admitted into the room, and all decaying fruit should be removed immediately. The practice of spreading out fruits on shelves, as formerly recommended in this country, and still practised in Europe, requires too much room and waste, and even in pretty close apartments they lose much of their flavor, and without extraordinary care will become dry and shrivelled. The better course, therefore, is to pack in boxes or barrels; and to avoid the necessity of handling, to pack them immediately from the tree.

One of the greatest obstacles to the preservation of late fruits is the warm weather of October and early November. When the apple and pear can be carried through these months without starting the ripening process, there is very little labor in keeping, especially the late sorts, through the winter, if stored in a proper temperature and suitable houses or cellars.

If fruits are to be kept for a long time, the temperature must be so low as to prevent fermentation of the juices; but it is possible to keep this so low, and so long, as to destroy the vitality of the fruit, producing a change analogous to the petrifying process. We have seen such instances with pears kept in modern fruit-houses controlled with ice, that could not be made to resume the ripening process. In these houses the temperature is regulated by ice.

Several different structures on this principle have been erected, and are now in operation in cities of the United States, for the preservation and ripening of fruits. These are of undoubted value for the fruiterers in large cities, who devote personal care to their management, but for the great mass of cultivators they are too expensive.

The fruit-houses of Prof. Nyce, one of which is located near Boston, are on the principle, discovered nearly a hundred years since by Dr. Henry, of keeping the fruit in an atmosphere of carbonic acid gas. This house is kept close, without ventilation, and has preserved delicate fruits, like the pear and grape, through the winter season in perfection. But while we admit

the principle to be correct, we fear that the constant and untiring watchfulness necessary for its success will so seldom be given, as to prevent their general use. Other houses, controlled by ice, for the preservation of fruits, are in successful operation in Philadelphia, but these are subject to ventilation, reliance being had on a proper supply of cool, pure air. We tasted specimens from these of the Northern Spy and other apples of the growth of 1868, in September last, in most excellent preservation, both as it regarded beauty and flavor. One of the Philadelphia houses preserves a working temperature of about 35° of Fahrenheit, the other 40°; but both are operated without any artificial dryer or absorbent, while Mr. Nyce's house is kept at 34°, and involves the use of chloride of calcium, to absorb any superfluous moisture from the air. In regard to the temperature, the object is to hold the ripening process in equilibrium, at a point neither *much above nor much below*, for, with an increased temperature, maturation would take place, and, with too low a rate for considerable time, the fruit would become materially affected in its quality. A temperature of 40° will hold the ripening process in suspense; but when the fruit is wanted for use it should be removed to a temperature of 55° or 60°, and ripening will succeed.

Various substances have been used for the packing of fruit, such as sand, charcoal, sawdust, chaff, &c., &c. None of these will preserve it for any considerable length of time, unless the temperature of the apartment is at the right point; but when this is attained superfluous substances are unnecessary, and are frequently positively injurious. In regard to temperature, different varieties require different degrees of heat, according to the firmness of the skin and the texture of the flesh.

Farmers understand pretty well how to keep their apples during the winter season by storing them in cool northern cellars; but the preservation of the pear and other delicate fruits is more difficult. For instance, the pear is a better conductor of heat than the apple, as may be seen by tasting specimens kept in the same temperature, the pear appearing the coldest to the taste. Owing to this better conducting power, it is more quickly affected by changes of temperature, and hence more difficult to keep.

Fruits are perishable commodities at best. What we want are houses so constructed as to avoid as much as possible the frequent adjustment of temperature, thereby preserving our fruits in a quiescent state until they are wanted for use, and thus avoiding the great loss which always occurs by the frequent handling of them.

The construction and management of the fruit-house demands science, skill and constant attention, with the power to control temperature, moisture and light.

After years of observation and experience, we have come to the conclusion that greater simplicity and cheapness are necessary, *for general use*, than can be found in these modern patent fruit-houses.

The location of a house for the preservation of fruits should be perfectly drained and dry. If it have a cellar, the walls must be laid and the bottom covered with cement. Whether built of wood or other material, there should be an inner wall. The space between the walls may be from six to nine inches, and should be filled with some non-conducting material, such as charcoal-dust, tan or sawdust. The doors and windows should be double, with a convenient space for opening them, and have a northerly aspect, so as to admit the cool air when wanted. In temperate weather air should only be given on a cool dry day or night, and when a warm spell occurs, as it often does in the autumn, the house should be kept closed until the return of cooler weather. The rooms should not be opened in damp or rainy weather, for it is better to suffer with the moisture within, rather than to admit more from without. To provide against an excess of moisture, a ventilating tube of four inches in diameter, rising through the roof of the building, with a regulating damper, has been found very serviceable. A box of chloride of calcium, or even unslacked lime, in the fruit room, will absorb superfluous humidity.

In regard to the materials for the finish of the rooms or boxes, we would recommend some kind of inodorous wood to those of a resinous character, as the latter is apt to impart its flavor to the fruit. In a word, the fruit-room should be as sweet and clean as that of the dairy.

To maintain a perfect equilibrium of temperature and moisture is the great desideratum. Too much moisture will cause

decay. Too much air will cause shrivelling. Too much heat will cause premature ripening of the fruit. But when winter approaches there is but little difficulty in the management of a fruit-house, if it is sufficiently protected from frost.

Those who expect to keep their fruits in good preservation, without special care in gathering, storing and watching, will most assuredly be disappointed. We therefore lay down the following rules as indispensable to success:—

Sound and perfect fruit.

Cool, pure air and exclusion of light.

Control of temperature and moisture.

Constant and careful supervision.

METHODS FOR PRODUCING NEW NATIVE FRUITS.

And now let me call your attention to what are the best methods for producing new and valuable *native* fruits. The great loss and disappointment which cultivators have experienced in the importation of European fruits, not adapted to our country, suggests the importance of producing new and valuable American varieties from seed. Another reason for producing new seedling fruits, is to replace those which may be lost by the deterioration of varieties.

However we may theorize in regard to this matter, it must be admitted, from the practical point of view, that some fruits have so declined as to render it absolutely necessary to replace them with new varieties. And what has been true in the past will be so in the future. Witness certain kinds of pears in our own day,—the St. Germain, Crassane, Brown Beurré, White Doyenné, and others,—once so excellent: where are they now? Some of these are occasionally to be seen on the virgin soils of the West and South; yet for the great majority of locations they will continue to be worthless. And even on these new soils, where they now flourish in their pristine excellence, we have reason, judging of the future from the past, to anticipate that no long time will elapse before this decline will reach these now favored regions. Within less than a generation, the pears alluded to flourished throughout Western New York, as well as, in their early history, on the propitious soils of France. And even among the more modern pears we notice—as, for instance, in the Beurré Diel and Flemish Beauty—signs of decadence.

And so with the grape. Where the Catawba and Isabella grapes once succeeded perfectly, they seem now to be failing and are no more to be relied on. Even the Concord now so popular, indicates that in time it may follow in the same degenerate strain. While we indulge in these forebodings, we cannot but express the deep regret we feel for the loss of such fine fruits. Other fine fruits are following in the same course. This should not discourage us, but rather increase our enterprise for the production of new sorts, to keep up with the deterioration which seems incident to cultivation.

Already we have ascertained that some kinds flourish throughout a wide range of territory; for instance, the Red Astrachan apple and Bartlett pear seem to prosper everywhere.

We therefore give a hearty welcome to the efforts and enterprise of all who are laboring in this praiseworthy cause. Nor can we too highly appreciate the lives and services of those pioneers in pomology, by whose intelligence and zeal most of our fine fruits have been originated or disseminated,—of Van Mons and Esperin of Belgium, of Duhamel and Poiteau of France, of Knight and Lindley of England, of Cox, Prince, Dearborn, Lowell, Manning and Downing of the United States, and of others now living, whose praise is in the mouths of all. What millions have rejoiced in the fruitage of the Summer Bon Chretien and Autumn Bergamot pear, coeval in history with the Roman Empire; the Newtown pippin and Baldwin apple, the Doyenné and Bartlett pear, the Isabella, Catawba, Concord and Scuppernong grape in our own time!

The advantage of raising from seed new varieties of fruits, is shown in the fact, that the native productions of a country are generally better adapted to its soil and climate than those brought from other climes. More than this, we often find that fruits originating in a given section of country, are especially suited to that region.

As illustrations of the hardiness and adaptation to the soil from which they sprang, we may point to the original trees of Seckel, Buffum, and Doyenné Boussock and Onondaga pears, of which we have accounts of their vigor and productiveness. The case is still stronger with the apple, it being a more local fruit; even the Baldwin, the most popular of all our New England

varieties, has proved not adapted to regions no further west than the State of Ohio.

Still another reason for producing new varieties, is to obtain kinds superior to those we now possess, for notwithstanding the number of fine fruits we now have, there is no reason to suppose that the possibilities in nature are exhausted. We want also to fill up the blanks in the seasons. In raising new varieties an object of special importance is to extend the season of fine fruit, by producing varieties, ripening at the beginning and end, of greater excellence than we now possess. How desirable to produce a pear as handsome and good as the Bartlett, ripening as late, and with the certainty of the Beurré d' Anjou!

What a prize to the cultivator, and what a boon to New England, would a grape be, the quality of the Delaware ripening the middle of August, like our wild grape of the woods, and possessing the hardiness and productiveness of the Concord!

It may be that nature has set limits to our achievements; it may be that time is requisite to produce size in fruits, so that we cannot expect our earliest varieties to be as large as our later ones; still, we may make some approach toward it; but he is a bold man, who, in view of what has already been attained, and this wonderful age of discovery, invention and enterprise in which we live, shall attempt to fix bounds to the acquisitions of the pomologist.

I have thus stated my reasons for attempting the production of new varieties of fruits, because it is often asked, why we should desire to add to the already long catalogue of fine sorts. When we consider the numerous valuable American varieties which have been obtained during the last twenty-five years; when we consider the great number of cultivators now turning their attention to this most interesting department of pomology, the multitude of seedlings now in growth from accidental sources, and the thousands of hybrids produced by artificial impregnation, our most sanguine hopes are awakened of richer and more abundant acquisitions in the future.

Our native fruits are fast supplanting foreign sorts. All of our grapes in cultivation, and nearly all of our strawberries, are of American origin; and the time is fast approaching when we shall claim for our apples and pears the same honorable ex-

traction, thus confirming the prediction made many years since, that "our best fruits will be derived from our own seedlings."

In regard to the best methods of obtaining new varieties from seed, my views have often been expressed, viz.: to plant the most mature and perfect seeds of the most hardy, vigorous and valuable sorts; and, as a shorter process, insuring more certain and happy results, to cross or hybridize our best varieties.

The process of amelioration by sowing the seeds of successive generations, on the theory of Dr. Van Mons, if founded in truth, is so long and tedious as scarcely to be worthy of trial. But we cannot define the exact truth of the theory, for we cannot estimate the disturbing influence of natural fertilization; and the impossibility of preventing this, where several varieties exist in the same ground, is apparent to all scientific cultivators. Under such circumstances, we could no more prevent an orchard of pears of different sorts from fertilization by the air and insects, than we could prevent a field of corn or a patch of melons, of different sorts, from mixing by the same process.

While most of our fruits have been produced by this process of accidental crossing, the number of finer sorts has been comparatively few and far between. We would not, however, discourage the planting of seeds of our best fruits, trusting to natural fertilization; but, to secure more rapid progress and better results. we must rely on the more certain and expeditious art of hybridization. By this means, we may, in a few years, produce such novel and desirable combinations as ages might not give us by accidental fertilization, or sowing seeds at random. In employing this agency, we only imitate nature; for, though the artificial process is but of recent origin, natural hybridization must have existed from the creation, and undoubtedly gave the first hint to man of the power within his reach. Nor can we doubt that the knowledge of this process is confided to man, by the Almighty Creator, that it may be developed to its utmost extent, or that, in pursuing it, we are doing his will and working with him. Here "the master-mould of Nature's heavenly hand" is placed within our own, so that the judicious and skilful operator may raise new and fine varieties of fruits with as much success as the farmer can produce improved animals by the crossing of his favorite herds.

What wonders this art has already accomplished in the production of new and improved varieties in the vegetable kingdom! How much it has done for the potato, the turnip and other vegetables, producing varieties of great excellence.

We have not yet fixed the exact limits within which hybridization may be effected, but we have learned some of the laws which control the process. Others yet remain to be discovered, and which bring to the pursuit a zest more fascinating than the games of chance, and with infinitely better results. But let us continue to sow the seeds of their best fruits, whether fertilized by themselves or by the hand of man. The former often produce good fruits, and with those which have been impregnated by the wind or insects, the chance for variation is much increased; but the union, by cross-fertilization, of the properties of two good parents, doubles the chance of obtaining a superior variety.

It is not necessary to be the possessor of a large garden to produce many new varieties of fruit. Some of the most successful experiments of this kind have been made in city gardens and grounds of small extent, as in the case of Dr. Brinckle's raspberries, Dr. Kirtland's cherries and Dr. Wylie's grapes. How often do we hear of seeds, sown by the delicate hand of woman in her flower-pot, which have vegetated and produced a fruit that has caused after-generations to rise up and call her blessed. Neither is the time that must elapse before the production of a new seedling fruit so long, as has been generally supposed. In some soils and climates, like that of California, seedling fruits often come into bearing in five or seven years; and even here in New England the period of fruiting may be greatly accelerated by grafting into dwarf stock or the limbs of bearing trees; and we have known the grape, in one year, from the seed, produce fruit, by inarching the baby seedling on a strong vine.

The doctrine that scions taken from seedling stocks and grafted into trees, however strong and healthy, will not yield fruit earlier than the mother plant, although held by so eminent a savan as Mr. Knight, President of the London Horticultural Society, has been proved to be fallacious; and numerous instances have occurred under our own observation where seedling pears have been grafted on bearing trees, and have

come into fruit while the original seedling had only attained the height of four feet.

The originator of new fruits should, however, fix clearly and distinctly in his mind the precise object which he wishes to gain. He should then select such varieties as possess in the highest degree the properties which he wishes to obtain. The most perfect seeds of these varieties should then be sown and so cultivated as to insure their most perfect development. In our experiments we may meet with disappointments, but let nothing discourage us in this delightful employment. By careful watching and experience, we may achieve triumphs of which we have now no anticipation.

Nor would I discourage the planting of seeds of choice kinds of fruit relying upon natural fertilization. By this process most of our best varieties have been produced, from which we are constantly receiving valuable acquisitions to our fruits. Think of the blessing conferred on posterity by the introduction of the Baldwin, Rhode Island Greening, Roxbury Russet, apples, Hovey's Seedling strawberry and the Concord grape, and what greater blessings can we confer on posterity than the production of a fine fruit which shall contribute to the health, wealth and gratification of millions long after we shall have passed from the scenes of life. Let me encourage every cultivator of fruits to sow annually the seed of all choice kinds in the hopes of transmitting to posterity some memorial of his interest in this most hopeful pursuit:—

> "Try all methods, hope great results;
> Who knows what meed thy labors may await,
> What glorious fruits thy conquests may create."

Mr. MORTON. What time of the year is the best for thinning fruit?

Mr. WILDER. Just as soon as you can see which the best specimens are. The earlier you commence after you have ascertained which the best specimens are, the better.

QUESTION. What is the best time to prune the apple?

Mr. WILDER. Just after the frosts of winter have passed. Never begin to prune until after the frosts of winter have passed, and commence as early as you can before the sap begins to flow; or you can prune in midsummer, after the wood is formed.

Dr. REED, of Pittsfield. We have for a few years past been troubled with a new worm, which has destroyed our finest sweet apples. It appears to be entirely different from the worm which has so infested the apple, and is about half the size of that worm. While other insects lay the egg in the blow, this worm eats inward and goes where he pleases, to the complete destruction of the apple. I can give you nothing of its history, but I hope some one may be able to tell us what the insect is, what time it deposits its eggs, and some way by which we can destroy him. Its ravages are entirely confined to the sweet apple and the milder kinds of the sour apple. I think the time has passed by in which they do most of their mischief. They commence with the Newtown Sweet, and destroy that apple almost entirely, in many instances. They then attack the later sweet apples. So far as I know, there are but few of them in the late apples.

The PRESIDENT. This whole question of fruit culture is now open for discussion. There are many gentlemen here competent to discuss it, and I hope some one of them will take the floor and set the ball in motion.

Mr. FOOTE, being called on to lead the discussion on that subject, said that twenty-one years ago some day in October last, surrounded by a goodly company of gentlemen gathered from nearly every State in the Union,—gentlemen the lineaments of whose features and the tone of whose voices (many of them now silent in death,) his memorable friend would readily recall at the mention of such names as Goodale, of Maine, Manning, Hovey and Walker, of Massachusetts, Barry, Thomas, Wilson, Robert Parsons, Samuel C. Parsons, Charles Downing, and the master-spirit in that movement, the lamented A. J. Downing, of New York, Reid and Hancock, of New Jersey, Brinkle and Hare, of Pennsylvania, Elliot, of Ohio, Phœnix, of Illinois, Allen, of Missouri, Taylor, of Virginia, and others,—he had the privilege to be present at the birth, and to assist at the christening of the American Pomological Society; and not only that, but to unite his voice in the unbroken harmony of all the voices present in declaring the Hon. Marshall P. Wilder its first president, an honor with which he had been reinvested, with no less unanimity, at each successive meeting of the society since, and that gentleman stood before them to-day, and before the

world, as *the authorized expounder of American pomology;* and anything with which he might be able to follow up a carefully elaborated and exhaustive lecture on the subject from such an individual, could only sound like the harmless prattle of an infant at its father's knee; for though, during many years, he had devoted such scraps of time as he could steal from the severer labors of the farm to the science of pomology, he felt that he had barely passed its threshold, and was scarcely worthy to be numbered with the initiated. Indeed, so grudgingly did nature part with her secrets in the domain of vegetable life and development, that the days of the years of one mortal life were hardly sufficient to enable one to master the A B C of her mysteries. This one truth, however, he believed he had surely learned, of whatever others he might remain ignorant, that the man who proudly boasted of his ability *to conquer and to control nature*, simply raved like a madman or babbled like a fool; while he who humbly submitted his judgment and his will to the clear dictations of nature, and made her well-developed principles and operations the guide of his efforts, would seldom fail to reap a satisfactory reward for his labors.

The partiality of old acquaintanceship had led the lecturer to allude to him in terms quite too complimentary, when on coming to the topic of "originating new varieties of fruit," he had said that "he would touch lightly on that subject, as he saw in the audience a gentleman familiar with its details, &c." He had, indeed, made some experiments in that line, for a number of years past, beginning, he believed, in 1852; and, if desirable, would try to give briefly the details of his practice. His system then, if such it might be called, was, first, in order to procure seeds of promise for his experiments, to select two valuable sorts (as for instance a Bartlett and a Flemish Beauty pear, or a Yellow Bellflower and a Fall Pippin apple,) and with a view to securing a cross between them, bring them into immediate juxtaposition, by grafting the one into a tree of the other. Second, to select from the product of such grafts the *finest specimens only*, and to plant *their perfect seeds* in well-prepared seed-beds in autumn. Third, as soon as the seedling plants were old enough to develop their peculiar characteristics, to *select only such as exhibited some marked peculiarity*,—taking it for granted, (whether right or wrong,) that only such would

be apt to produce *fruits* of a marked character. Fourth, to graft these selected seedlings upon strong, healthy stocks, or into the upper branches of vigorous bearing trees, and wait for them to show fruit. If the specimens from any particular graft failed to give any indications of excellence, that graft was at once removed to give place for another candidate. He must acknowledge that his experiments thus far had resulted much more in favor of pleasure than of profit, the number of failures in his seedlings greatly preponderating over his successes. Yet he had never for a moment been tempted to yield to this discouragement. On the contrary, he had constantly felt his ardor in the pursuit increasing instead of diminishing. The production of a *few* choice varieties of the plum, apple and pear, particularly of the latter, had not only served to keep him from despairing, but furnished ample stimulus for perseverance. The pursuit of this branch of horticulture, viewed in some of its aspects, might not inaptly be compared with *that of the angler;* who finding ordinarily but little to animate him, yet gets *occasionally* "*a glorious nibble*" that serves to keep his circulation from flagging, and *once in a great while bags a magnificent specimen*, that quite electrifies his blood, and sends him pacing along up the stream with new enthusiasm, quite forgetful of his past ill-fortunes, and dreaming of new successes.

Consider that to constitute a fruit of the finest quality and of the highest value, (taking the *tree* as well as the fruit into the estimate,) not only the form, size, color, texture, flavor and keeping qualities of the *fruit* itself must all be right; but the vigor, hardiness and productiveness of the *tree* assured also, and we need no longer be surprised that in the drawing of a single prize so many a blank is turned up. Not least among the sources of pleasure to be found in the growing of new seedling fruits, was that curious and unaccountable *sporting* of varieties with which nature was constantly surprising and amusing us. He had, in the course of his experiments, produced but a single fruit (a Green Gage plum,) which he could regard as a perfect reproduction. He had raised a Seckel pear, and Pound Sweet apple, which, to an uneducated eye or palate, might appear identical with the originals; but a connoisseur would readily detect certain shades of difference in the form, texture and flavor of either of them. On the other hand, the great majority of his seedlings would as

soon be referred for their origin to any other fruits in their own class as to their real parents; and in regard to numbers of them, the incredulity of the knowing ones themselves would be excited by the disclosure of their true parentage. He would give a few examples of these singular variations. [Which he did, in part, by specimens exhibited to the audience.]

Of two seedling Green Gages, one—described in Downing's new edition of "Fruits and Fruit-Trees of America" as Foote's Golden Gage—was nearly twice as large as the parent, of a clear golden-yellow color, vinous in flavor, and a clingstone; the other but about one-half as large as the parent, of a dark blue color, and a freestone. An Imperial Gage seedling, much resembling its parent in form and size, was of a dark purple color, not of vinous flavor. A Northern Spy (apple) seedling, only half as large as the original, greatly resembled, externally, the old Russet Pearmain of some of our ancient orchards, was very dense in texture, and promised to be a good keeper, and a very rich fruit. A seedling Williams' Red, nearly as large as the parent, darker in color, softer in texture and as mild in flavor, would keep all winter. Of two Yellow Bellflower seedlings, one was three-fourths as large as the parent, resembling it in form and in its ground color, but having uniformly a brilliant crimson cheek, kept as well, was more productive, and of even higher flavor; the other would be sufficiently described by calling it a mere Yellow Crab, which it resembled in all its characteristics. A Twenty Ounce seedling much resembled its parent in form, size and color, but was *sweet*. Of two Mother seedlings, one, larger than the parent and more beautiful in its (similar) form and color, was a *sweet* apple, keeping till spring; the other *very small*, pure *white*, was a *sweet* apple also, and a late keeper. Of three Porter seedlings, one greatly resembled the parent externally, except in a brilliant crimson cheek, but rotted badly on the tree; the other two, smaller than the parent, and without any attractions of form, color or flavor, were both *sweet*. A Winter Golden sweet seedling was larger than the parent, Bellflower shaped, of the purest white, fine-grained, exceedingly tender, mildly *sub-acid*, and ripened in October. A Bartlett (pear) seedling resembled not a little, externally, the Merriam, and was well-flavored, but rotted quickly at the core. A Bleeker's Meadow seedling, very much resembling the parent

fruit in form and size, and a true "*chip* of the old block" in texture, was as beautifully colored as a bright "red rose." A Marie Louise seedling, not very unlike a medium Virgalien in form, size and color, was a pleasant sweet pear and remarkably productive, its bearing branches hanging like those of a weeping willow, quite down to the ground; apt to rot at the core. A Dix seedling retained much of the form and size of the parent, but took on a yellow color at maturity and was wanting in flavor. A Summer Franc Real seedling much resembled the Dearborn in form, size and color, (except that it was specked with red as beautifully as any trout,) and had a distinct Bartlett flavor. A Washington seedling had nearly the form and size of the Bartlett, with a dull bronze-yellow skin, and by its flavor reminded one of Stoughton's bitters or some kindred article. A Beurré d'Anjou seedling, by its form and size, reminded one of the old English "bull's eye" watch, and, by its texture, of India rubber, and kept so well that it never got ripe. Of two Onondaga seedlings, one resembled Urbaniste in form, size and color, and ripened in October; the other was of a peculiar oval form, a uniform dark-bronze russet color, and a winter fruit—quality not yet tested. Of several Virgalien seedlings, all varying widely from each other, the most noticeable was a light-russet pear, about the size and shape of Rostiezer, an excellent keeper, of good flavor, and promising to be of value. Of several Seckel seedlings, most of which bore a nearer or more remote resemblance to the parent, the only one of particular promise was that described in Downing as Foote's Seckel—a pear somewhat larger than the parent, shaped much like a Gansel's Bergamot, more handsomely colored than the original, and somewhat more vinous in its flavor, which, in the opinion of some, gives it a superior value. This and a Beurré d' Aremberg seedling of much promise, were regarded as his greatest successes.

In regard to the general subject of fruit-culture, information was so abundant and so accessible at the present day, concerning all its important details, that he did not deem it necessary to add much, if anything, in that direction. He would, however, avail himself of the occasion to enter his protest against the utter recklessness with which many, he might perhaps say most men, rush into the business of setting out pear and apple orch-

ards, as if a piece of ground of certain dimensions, and a given number of trees stuck into it, without any particular regard to the quality or condition of either, would, by the grace of nature alone, be amply sufficient to insure success. Experience was a dear schoolmaster, but many were receiving his teachings on this subject now-a-days with great seriousness, and he hoped that knowledge and wisdom would be increased thereby, though to many, he feared the acquisition would come too late to administer much of either profit or comfort. For himself, were he about to begin the business of orcharding anew, he would be far more particular in selecting soils and locations, varieties of fruits and styles of trees; prepare his grounds much more thoroughly and expensively; plant fewer trees and plant them more carefully, and then bestow on every ten the attention he had heretofore divided among a hundred. This his own experience and observation had satisfied him was the only proper way of growing fruit at this day, whether for profit or for pleasure. He would add but two things more: first, that in preparing for the planting of *pear-trees*, he would trench the soil—*not dig a well and fill it up again;* but *loosen the whole surface* of the soil, and enrich it with a variety of animal and mineral manures, *to twice the depth ordinarily reached* in these processes;* and then, having the soil well fitted and the trees carefully selected, his advice would be to throw the latter into the fire sooner than set them, if either the *surface* be found habitually *wet*, or the *subsoil very retentive of moisture.* It would be better economy to *purchase* the fruit desired by devoting the land to more profitable purposes. Second, in these days of multitudinous and *multitudifying* insect depredations, he would by no means fail so to locate an apple orchard that he could conveniently occupy it, whenever he chose, *as a hog-pasture.* This he fully believed to be the very best possible mode of ridding an orchard of and keeping it free from its insect enemies, and realizing again such crops as our fathers did before

* He had followed the tap-root of a common red clover plant downward to the perpendicular depth of nearly five feet; and the pear root extending itself naturally in the same direction, he could not think it safe to disregard this indication of nature in preparing the soil to receive it. The most successful instance of pear-culture that had come to his knowledge was on grounds that had been carefully trenched and manured to the depth of six feet.

the extermination of the forests had filled our orchards with these modern pests. When Dr. Loring, in discussing "rotation of crops," had discouraged the raising of *carrots* for horses, and highly recommended turnips instead, saying that his horses liked them much and throve on them finely, Mr. F. remarked that the *human* animal *could be educated* to eat *tobacco*, and he had no doubt that *horses could be educated* to eat *turnips*. But somehow or other he never could persuade his horses to think them very good, and whenever he offered them a mess, they seemed to say to him, "Good master, do take away these disagreeable things, and give us a small mess of carrots instead, if you please."

Prof. CHADBOURNE. I would like to ask one question. I understand, that in order to produce the pears from which you take the seed, you graft one variety into another. Why do you do that?

Mr. FOOTE. My object is to bring the two varieties into juxtaposition, so that there shall be a cross-relation between them.

Prof. CHADBOURNE. I want to know whether you suppose that the effect comes from the passage of the pollen from one part of the tree to the other, or rely somewhat upon the stock you graft perfecting the character of the fruit?

Mr. FOOTE. I am not enough of a vegetable physiologist to answer a question of that sort with much intelligence. I have supposed that in that case, the fruit might partake more of the character of one sort or more of the other; but I really do not know how that is.

Prof. CHADBOURNE. You hold that the stock into which you graft really affects the fruit to such an extent that it will have an influence upon the seed?

Mr. FOOTE. No, sir, I have no such idea as that. In improving domestic animals, the great maxim relied upon, is that like produces like. That theory my specimens would seem to refute, so far as the growing of seedling fruits is concerned.

Col. WILDER. Those varieties, perhaps, are crossed by the wind.

Mr. FOOTE. Probably that might be a disturbing cause. I would like to ask a question or two of Col. Wilder. I suppose that if I a take a pear-seed and plant it, the result will depend entirely upon the organization or composition of that seed, and

therefore that the success of any experiment in planting seeds for growing seedling trees depends entirely upon the selection you make of your seeds. By what rule can we be governed in making that selection?

Col. WILDER. I believe I have already expressed my views on that very point—that it is necessary to select the best and most perfect seed. The system of grafting two varieties into one tree, that they may be fertilized by the wind, is another process of uniting the kinds; and when the seed has been procured, after the one has been fertilized by the other, a variation will be produced, but it is impossible to say what it will be. But the great law of having strong parents, or even strong parent seed, I suppose holds good throughout all creation.

Mr. FOOTE. What is the best system for the production of new varieties? Do you prefer artificial cross-fertilization to any other mode?

Col. WILDER. That is a delicate operation, but the success is more sure and the progress more rapid; we get a great many more fruits. There is no better illustration of what may be done by sowing seeds than the fruits Mr. Foote has shown. Those are American fruits; they are sure to succeed here. They have got the elements that are necessary to make them successful. What their precise qualities are must be ascertained hereafter, but many of them have beauty and size. If Mr. Foote, in his long and industrious life, should only produce one good variety, adapted to our soil and climate, he would be a public benefactor. Think of the number of persons in this country engaged in the cultivation of fruit! Should each one produce as many varieties as Mr. Foote has produced, we should have enough to last for centuries, of varieties adapted to every soil and location in our country.

Mr. SLADE. I understood Col. Wilder to remark, that in order that fruit may retain its preserving qualities, it should be put up moist and not even wiped. That is contrary to my experience. I have always succeeded best in preserving fruit by wiping it dry.

Mr. FOOTE. I intended to have added to what I said in relation to these seedlings, that I have produced three or four Seckel seedlings, one of which has the very decided approbation of Mr. Downing, who has repeatedly pronounced it superior, to his

taste, to the old Seckel. It is somewhat larger in form and handsomer in appearance, and the tree is vigorous.

Col. Wilder. That is a very fine fruit, and bears the name of "Foote's Seckel." It is recorded now in Mr. Downing's book, which is an encyclopædia of pomology. It is a remarkably fine pear.

In answer to Mr. Slade's inquiry, I will remark, that I meant to say, and believe I did say, that nature has furnished a waxy secretion for the protection of fruit, and if it is robbed of this, it tends, in my opinion, to injure it.

Mr. Slade. I had an idea that by wiping, this waxy substance was more equally distributed over the skin of the fruit, and the air more effectually excluded.

Col. Wilder. In what season do you wipe it?

Mr. Slade. When I pick it in the fall.

Col. Wilder. The best system I have found with pears is to pack them immediately into boxes, being very careful not to have the stems bruise the fruit. These boxes are carried into a cool cellar and piled up, with a strip of wood between them, and there they remain until sent to market. I packed my Beurré d'Anjous in that way. I do not want them touched after they are picked from the trees until they are carried to market. Apples can be managed very differently from pears.

Mr. Gold. Dr. Reed exhibits a specimen here, and asks something with regard to the character of the worm which has done the mischief. I believe it is what is called the apple maggot. I know very little of its history, but a great deal of its ravages. My attention was called to it some four or five years ago, in the valley of the Connecticut, as infesting their sweet apples. The apples appeared perfectly sound, but when cut, they were proved to be perfectly worthless. [A specimen was exhibited.] When the apple was gathered from the tree, it was apparently perfectly sound, but the maggot was at work in the interior, and in a month or two, it was completely riddled or honeycombed, and good for nothing. My attention was called to it first from the vicinity of Middletown, Conn., where I was told that it had entirely destroyed some varieties of sweet apple, so that they were utterly useless for all other purposes, except to feed to animals. We saw them at Iona, at the sale of Dr. Grant's grape-vines, about a year ago. Some of us gathered

specimens from under his trees, and found the maggot in the fruit—showing that they are there also. In the place where I reside, West Cornwall, Litchfield County, I have found a very few apples affected, and Dr. Reed tells me that from Canaan, another town in Litchfield County, he has had fruit sent to him that was affected in this way; so that the ravages of this worm would seem to be quite wide-spread. Mr. Foote was right in his remark, that it infects mostly sweet apples, yet it sometimes infects sour apples, in a milder form. My attention was also called to it in the vicinity of Providence, R. I., as having destroyed some varieties of sweet apples. I have nothing to suggest in regard to its prevention or cure.

Mr. Goodman. This [the Beurré Clairgeau] is one of the favorite pears in Pittsfield, owing to its fine flavor as well as its color; and down in Lenox, most of the pears that we consider hardy and well growing will do remarkably well on our limestone soil. My own nursery of dwarf pears has been a great success. The only great loss has been owing to pear blight. I find no difficulty in raising as fine pears as I have seen anywhere else.

Mr. Foote. I might have made the same remark in regard to another quite celebrated pear—the Duchesse d' Angoulême. I have had that in cultivation for twenty years, and it has not been worth as many cents. Mr. Downing of Newberg, has informed me that it is of very poor quality over clay.

Mr. Goodman. With me, that is one of the finest eating pears I have.

Question. What kind of manure do you use?

Mr. Goodman. I have used ashes and the animal manures.

Dr. Loring. I want to say a word at this stage of the discussion, partly in self-defence, and partly for the sake of my own edification and education. I have claimed for a long time, and I have been confirmed in my theory this afternoon by what has been said by the two experienced gentlemen who have addressed us, that the matter of fruit growing is a matter of horticulture. That means, Mr. Chairman, careful cultivation; the skill of the gardener, exercised upon something that will not grow by the rough-handed skill of the farmer. I am satisfied that the wholesale and general growing of apples that was in vogue in this country, and successfully in vogue twenty-five or

thirty years ago, can no longer be pursued to a profit; that the business of raising fruit, both pears and apples, has become an intricate, careful and elaborate business, and requires a more thorough understanding of the nature of the soil and climate than almost any other branch of horticulture that can possibly be named. I have recommended, therefore, in various parts of this State, the destruction of old orchards, and I desire to give my reasons here, because I have recently been criticized somewhat severely for having advised the farmers of Worcester County to remove their old apple-trees from their farms as excrescences and nuisances. The reasons I give are these: that owing either to a change of climate, or a change of soil, or both combined, and the incursions of the canker-worm, the caterpillar, the core-worm, and the burrowing maggot, to which Mr. Gold has alluded, the contest has become an unequal one, and we cannot carry on the cultivation in the old way. I would have apple-trees planted in the first places upon soil adapted to them. Let horticulturists find out what that is; probably no two kinds ever could or will flourish equally well upon the same soil. The Baldwin apple of Berkshire and the Baldwin apple of Essex are two different things, not only in texture, but flavor, owing, unquestionably, to the difference in the soils upon which they grow. Let the horticulturists teach us what soil is adapted to the growing of particular kinds of apples and pears. My impression is, that those soils that are deficient in mineral matter are the least adapted to the growing of apples. I know that in our own section, apple-trees grow best upon decayed and decaying ledges; upon hill-sides that are filled with decaying rocks, where there is an abundance of mineral manure, and an absence of those vegetable, nitrogenous manures which simply stimulate the trees into the growth of wood, but will not produce fruit. The smoothest and best orchards I have ever seen anywhere are those grown on lands rich in mineral manures; they are the orchards which first come into fruitage and retain their capacity to bear longest.

Now, with regard to planting trees in such land. The best orchard that I know of (and I would like to have this controverted, if possible,) is planted so that the trees protect and nurse each other. I think our trees have become so delicate that the effect of the winds upon them is more sensibly felt than

it was years ago, when they had a better soil, and grew more vigorously. I know an orchard in the State of Vermont, exposed to all the north-west winds that blow from the Adirondack Mountains across Lake Champlain. The trees are planted upon land that has been thoroughly drained, and filled with an abundance of various kinds of mineral manure, and they are so close together that I doubt if the sun ever penetrates those branches; and yet, the best fruit I ever saw in the State of Vermont grows on that orchard. So I say it is proper selection of soil and careful cultivation of the trees that will enable us to raise fruit properly and profitably.

I say this, because I agree with Col. Wilder, that the cultivation of fruit is one of the most interesting, most profitable and most useful branches of culture known among gardeners and horticulturists; and more than all that, because I desire in every way possible to avoid the odium which is gradually coming upon the business of planting orchards. There is no question that in the eastern part of this State the farmers have become tired of the business, and they are removing their old trees without planting new ones. And that feeling is increasing. One of the best farmers in the southern section of this State, near the Connecticut River, came to see me in regard to planting a large orchard of a thousand apple-trees, and when we had got through discussing the matter, he said: "I know this seems like boy's play; I know it looks as if there was no money in it. I shall have an orchard of a thousand trees, and nothing will come of it for twenty years." He was going to do it as a matter of custom, and yet he knew he was defying wind and weather. It is on this account that I so strongly urge the abandonment of the wholesale planting of orchards, the removal of old trees, and the putting of new ones in soil particularly adapted to them, avoiding the excessive use of barnyard and nitrogenous manures, which increase the growth of wood without stimulating the production of fruit, and of devoting ourselves to the growth of apples and pears in the best way that can possibly be conceived of, as a matter of horticulture, and not of agriculture. I am glad that the remarks which have been made sustain me in that position, and I make this public statement here because I desire that those members of the Board of Agriculture who may possibly have seen the reflections cast upon my statement here-

tofore made, may understand precisely the attitude which I have assumed, in which I have been confirmed by the experience of those who have spoken before me.

Mr. BEEBE. I own a large amount of mountain land, and apple-trees are scattered all over that territory, in the woods. Three or four years ago there was a very dry season, and there were hardly any apples in this country, but wherever I found one of these wild trees near live water, that tree was full of apples, in many instances bent to the ground; but wherever a tree stood on dry loam or in the woods, entirely sheltered, and no water visible, there were no apples. I infer from that, that live water may be a good thing in the production of apples.

Mr. MOORE. I would like to ask the Doctor if he would advise us to pull up all the apple-trees where the prohibitory law is at work? That law has made cider apples worth two dollars a barrel in my place. That will never do. What are you going to do without cider?

Dr. LORING. You may not get as much cider cultivating trees in the way I have suggested, but you will get a great many more apples.

Mr. MOORE. I do not care anything about cider, because I drink but little of it; but I have raised good crops of apples right straight along, and I do not know why the rest of you cannot. I do not believe at all in the theory that orchards exposed to the wind will not bear anything.

Dr. LORING. There is no theory about it; it is a fact.

Mr. MOORE. I have a row of five or six apple-trees, standing in a field so situated that, if the wind blows anywhere, it blows like a hurricane there. Yet I got from those trees, this year, some twenty barrels of apples, that brought $6 a barrel. Last year I got a lighter crop, and the year before twenty-five barrels. There have been no crops grown under them. If I can raise apples, I do not know why you cannot. I do not believe that doctrine.

Then, while I respect and admire Col. Wilder, and believe in about all he says, I do not believe in his theory about peach-trees. I admit that I have lost almost all my peach-trees. Twenty years ago I raised peaches so abundantly that I dumped large quantities of them into the pig-pen. Previous to that time, the disease called the yellows started down in Delaware,

and destroyed the orchards, travelling north and following the seacoast at the rate of about twenty-five miles a year, until it got up into Massachusetts, and destroyed nearly all our trees. In Delaware, the peach-trees are now bearing good crops, and they are raising peaches as well as they did twenty-five years ago. I believe that peaches are going to be raised here as they used to be. Last year I planted three hundred and fifty trees, selecting what I thought to be the best soil—that is, a high, dry and light soil. The trees I planted were one year old from the bud, with the side branches all topped off. Those trees are now eight feet high, and almost every one of them bore peaches this year, and they are looking finely now. I am willing to put my trust in Providence, after doing what I can. I am not like the old gentleman down in Rhode Island, who got discouraged in consequence of the failure of his crops, and complained to his clergyman that he couldn't raise anything. "Put your trust in Providence," said the minister. Said he: "I have tried that market a long time, and I would ten times rather have Boston." Now, while I will put my trust in Providence, I can tell you Providence is not going to do anything for you unless you do something for yourselves. You have got to take care of your trees—do what is right by them—and then put your trust in Providence, and you will raise your fruit yet.

Now in regard to grapes. I have no difficulty in raising grapes. Two years ago last spring I planted seven hundred grape-vines, and this year I have taken two tons of grapes off those vines, for which I got about $500, and had the money in my pocket. That does not look as though we could not raise grapes in Eastern Massachusetts. I have sold some eight tons of grapes the present year. I have some four acres of vines, and those vines have been growing without any drain on the rest of the farm for manure. There is another thing. Those vines were planted on an old worn-out rye field, without a particle of manure for some five years, except that it was planted two years with squashes and melons, manured in the hills, eight feet apart. There was no other application of manure, of any kind, except what I will tell you now. The vines were planted ten feet one way and seven feet the other, with rows of strawberries planted between; and those rows of strawberries were manured with the ashes of some old stumps taken from the

same lot. Those strawberries, which were planted on perhaps five-eighths of an acre, and of course did not cover that, because the vines occupied half of the ground, produced $400; and fruit from these vines took the first premium for the six best varieties in the Massachusetts Horticultural Show. Fifteen years ago that land would not have brought ten dollars an acre. What is the use of saying you cannot raise fruit? You can raise it without any trouble. You have only to go to work and do it.

Col. WILDER. My friend Capt. Moore and myself believe in good cultivation, but I am afraid this audience will draw the conclusion, from his remarks, that the poorer the soil, and the less they manure, the better the crop will grow.

Mr. MOORE. I would not be understood that way. I should have said, in regard to growing grapes, that the wood that produces good fruit is medium-sized, short-jointed and well-ripened. That you cannot get, where you put on a great quantity of manure, with the strong growing kinds.

Col. STONE. I should think that land that would grow strawberries would grow grapes.

Col. WILDER. The remarks of Dr. Loring and Capt. Moore both go to show that nothing can succeed permanently without care and attention. The members of the Board who know Capt. Moore, know him to be one of the best cultivators in the State. He has been remarkably successful with his Concord vines on his hill pasture, where scarcely anything else, according to his own account, (and I have no doubt he is correct,) would grow. That is an instance showing what the vigor and hardiness of a seedling grape, raised on our own soil, has done and can do. I wish that every gentleman in this assembly who has ever cultivated any fruit, or ever intends to, had the same feeling in reference to the matter as Capt. Moore, and would say, "We can have peaches, and will have them." But I will say that I have drawn my conclusion that the time for peach culture in Massachusetts has passed forever, from the experience of the last forty years. Almost every year I have planted some peaches, believing that now and then I should have a good crop, but I have not got a crop six years out of the forty. I think it arises from the fact that our forests are cleared off. The peach will not stand this cold, bleak climate, these fierce, dry winds,

these sudden changes of temperature, which it did not have to endure when it succeeded here. It succeeded here once, just as well as our forest trees, but then it was sheltered everywhere; and now, if we see any peaches, we find them in sheltered locations and in gardens. Why do we see them there? Because they are protected from the high winds and excessive cold to which I have referred. I want every man to plant some peach-trees every year, but I believe the time has gone by forever for their general cultivation. I believe that the disease to which Capt. Moore has alluded is caused by the inclemency of the weather, the changes of temperature, &c., to which I have referred, and it may well be perpetuated if those trees are used for grafting and budding. But still I intend to plant peach-trees, although I believe they never can be cultivated again, and never will succeed again in New England, except in very sheltered places.

In confirmation of that theory, that fruits need protection, I will mention that we get, in our Boston gardens, as handsome white Doyennes,—the old Virgaliens,—as we ever got in the world. That pear used to succeed like our apples, and was piled up in our orchards and barrelled there. It is just the same at the West. I once saw in the grounds of Barry & Ellwanger, at Rochester, on five-eighths of an acre, forty barrels of the old Virgaliens, or St. Michaels, as handsome fruit as any-one could wish to see. They cannot grow them at all now. But a few years ago the Flemish Beauty was a great pear. We cannot grow it now, and have abandoned it. This decadence has extended as far as Rochester. But there came to the National Pomological Society, from Kansas, such specimens as I had never seen before. The secret is to be found in the fact, that they were grown on new soil, and the trees protected by forests.

Mr. Foote. I would like to know Col. Wilder's experience in regard to deep cultivation for the pear.

Col. Wilder. I approve of deep and thorough cultivation and thorough draining, but no spading or ploughing among the trees after they get into bearing condition.

Mr. Foote. I have a single fact in my mind in regard to tap-roots, which I would like to state. Some years ago I came across a clover root which I traced to the depth of over five

feet. I think we are not aware, usually, of the depth to which our roots run. I have also seen a tomato root nine feet long.

Col. WILDER. I once trenched a piece of strawberries, and very barely manured it; and I traced a strawberry root four feet deep.

Dr. REED. How has the Flemish Beauty succeeded this year?

Col. WILDER. This has been one of the favored seasons. Two years ago we had continual wet weather, while the West had the most beautiful dry season you could imagine. We have had one of these fine seasons this year, and they have had too much moisture; their grapes have rotted and mildewed. My impression is that the Flemish Beauty, and, I am sorry to say, the Beurré Diel, are coming to the same decadence, like the old Virgaliens. But we shall have exceptional seasons, perhaps.

Dr. LORING. I agree with Col. Wilder in his compliments to Mr. Moore's cultivation, when he states how successful he has been in growing peaches. I have not the slightest doubt of it in the world. He knows how to plant a peach-tree. And when he tells how well he has cultivated strawberries, or how successful he has been in raising apples, in and around Concord, I do not doubt it at all. It is simply a proof of what I have said, that certain soils are adapted to apples and certain soils not. Every word he said confirmed my statement, that it is careful cultivation and proper soils, and the application of manures adapted to trees, and not adapted to field crops, that make a man a successful fruit-grower. I do not want the farmers of Berkshire to suppose for a moment that I would advise them to cover their grass or strong grain and root lands with orchards, because I do not think it is a kind of farming to which they can devote themselves to a profit. I have said over and over again, and it never has been controverted, that a judicious selection of soils, (not soils devoted to heavy growing crops) a proper application of mineral manures, phosphates and bones, and above all, protection to the trees, will enable the New England farmer to contend against the evils to which Col. Wilder has alluded. We have more and more insects attacking our trees, and how we are to avoid them, nobody yet knows. Man cannot do it, birds cannot do it; and as a last resort, there are those of us who are experimenting with the utmost care to determine if it is not in the power of man to let loose parasites to destroy them.

That parasites do destroy the canker-worm and the caterpillar is well known; the only question is, how man can control these parasites and let them loose upon these destructive insects at pleasure. Providence has fixed a limitation to artificial life, and the more artificial a fruit is, the sooner it reaches its limitation by some extraordinary law; that law which has driven the St. Michael's pear out of New England, which has brought some varieties of the potato to an end, which has crushed down all the buttonwood trees, and which seems to apply to all forms of vegetable life on which man has laid his hands. These are the difficulties against which we have to contend. How? Simply, as Col. Wilder and Mr. Moore have told you, by the application of the best laws of horticulture in the selection of lands, in the selection of trees, and the application of fertilizers. It seems to me that is perfectly apparent.

Adjourned to evening, at $7\frac{1}{2}$ o'clock.

Evening Session.

The Board met at the hour assigned, and was called to order by Col. Stone, who said:—

Ladies and Gentlemen,—Owing to an engagement of our honored friend, the Hon. Marshall P. Wilder, to-day, I occupied the position that I now hold. He has kindly consented to assume the responsibilities of this position this evening, and I have the pleasure of introducing the Hon. Marshall P. Wilder.

Col. Wilder. *Ladies and Gentlemen*,—It affords the Board of Agriculture great gratification to witness this large and highly respectable assembly. But it is not the presence of the Board of Agriculture that has called you together. It is the announcement of a name which not only commands universal respect, but universal honor and gratitude. I beg to introduce as the lecturer of this evening, Prof. Louis Agassiz, a member of the Board.

FISH BREEDING.

BY PROF. LOUIS AGASSIZ.

Ladies and Gentlemen,—The subject selected for this evenings address is that of Fish Breeding. It is a subject which has of late years attracted considerable attention everywhere, on

account of its importance as another means of supplying crowded communities with food; and the kind of food which is derived from fish is one of peculiar value. Although it is not everywhere estimated at its full importance, there can be no doubt that as an article of food fish has a physiological significance which cannot be overrated. All living beings grow and supply their waste by appropriating from outside, in various ways, the means of sustenance; and that food is the food adapted to their nature. Cattle feed on grass, and they have been so organized, that out of grass they build that frame which has so many valuable uses for ourselves. They make meat out of grass; they make milk out of grass; they make hides out of grass; and if they can do that, it is owing to the fact that their structure is adapted to the transformation of such kinds of food as they eat into those substances which constitute their frame, and those fluids which are secreted by their organs. Every kind of animal has a peculiar kind of food, and knows how to choose it by instinct, and all fare well in proportion as they find a sufficient supply of that food which is best adapted to their constitution and organization. Man lives in a manner similar to these kindred living beings on earth, by appropriating food also; and he must take that food which will make him a full man, if he would have all those attributes which characterize mankind. All those individuals who, from fancy or for any other reason, live exclusively on some particular article of food, deteriorate their natures, deprive themselves of some of their power; and it is only when man finds and appropriates to himself that food which will secure his normal growth, and will repair all the waste resulting from the exertion of his faculties, that he maintains himself in the proper condition.

If there is any one thing which characterizes civilized man, it is his intellectual activity. There is nothing which is taxed so much in a civilized community as the brain, and the brain must be fed; and it requires a kind of food which is not to be supplied by every article of diet. Chemists will tell you, that, in order to the performance of the highest functions of the human brain, there should be a certain amount of phosphates introduced into the system; that the phosphates which you use for manure, and as a means of improving your agricultural products, in another form, are a necessary article of food for

man, if he would keep his brain in a proper condition. Now, of all the substances which can be appropriated by man, digested by the human organs, and made part of our system, there is none which contains so large a quantity of these phosphates, and in a form so easily appropriated, as fish. It is for that reason that a fish diet is to be recommended. A community in which there is a vast amount of intellectual activity—and I know of none in which there is more than in this—ought to be accustomed to a fish diet; ought to take every means of increasing that article of food, of making it easily accessible and cheap, and of introducing it largely among the articles of daily food. These facts have been ascertained so well, that I need not dwell upon them more fully. And yet it is not long since it has been known. It is only some thirty odd years since it became known to what an extent a fish diet was adapted to repair the losses and waste of our cerebral system. I need not, therefore, say anything more as a recommendation of that new industry which is attempted to be established among us. But I would say a few words concerning the supply of food generally, that it may be understood why fish must be raised artificially, if we would have a sufficient supply.

In order to show it, I need only allude to the unquestionable fact, that the whole population of the United States, amounting now to forty millions, lives upon food which is for the greater part foreign to this continent. That population could not be sustained were it not that its food is artificially produced. Our domestic animals, also, are kept on food which is foreign to this continent. If we did not grow that food, we could not raise those large herds; we could not supply the farm with those horses which are so indispensable for all agricultural purposes. The whole is an artificial product, and civilization progresses in proportion as the conditions are favorable to increasing and enlarging this produce from the land. If you compare the savage nations with civilized nations, you will at once understand, after these remarks, why they are so sparsely scattered over the surface of the earth. You will understand that the wild animals do not multiply so as to increase in numbers. It is not only because man hunts them down, but it is because they are dependent for their living upon food which grows naturally, which is nowhere multiplied for their increase, which they are inca-

pable of multiplying themselves, and therefore the limitation to the increase of all animals which are in their natural condition. The same thing applies to cultivated plants. We find nowhere any kind of plants growing naturally in that crowded condition in which we plant them in our fields; and yet we are able to raise such large crops because we feed the plants with manure, we give them wherewith to live, and, by multiplying artificially the food of the plant, we increase the means of sustaining the larger animals; and we are enabled ourselves to live in crowded communities, because we live on food artificially raised, which can be supplied almost without limit. Those wild tribes which eat fish extensively, are yet sometimes famished because they cannot get a sufficient supply of that food. They have not learned how to multiply, as we have already learned to multiply, some of the animals and some of the plants which are so important to our prosperity.

Now fish-raising or fish-breeding ought to be conducted on the same principles on which the growing of all these various products which are cultivated on the farm is carried on. That is, not to follow strictly the indications of nature, but, having learned from nature what are the most favorable conditions for the growth and reproduction of various kinds of fish, enlarge the capacity of a breed, and in that way increase the number.

There is another feature which is very important in fish breeding, and that is, that we can control their increase perhaps more readily than we can that of other animals, on account of the very large number of eggs which they lay. There are fishes a single female of which lays many hundreds of thousands of eggs at one time. If we could secure the conditions which would prevent the largest proportion of these eggs from being wasted, from becoming the prey of those animals which feed upon them, from being carried by currents or tides, or the winds, into places which are unfavorable for their growth; if we could, in fact, secure the perfect development of every one of those eggs, you see at once how largely we might multiply animals which apparently do not increase in number in their natural element, and we have therefore to learn, in order to be successful in fish breeding, first, what are the conditions which are most favorable to the growth of the different kinds. And here we shall have to learn a great deal which is not known, and which I am not

able to tell you. Fish breeding has been practised thus far, in the old world, upon fishes no one of which do we find in our waters. Therefore, whatever has been learned in fish breeding abroad will avail us only in a measure,—to the extent to which our fish resemble those fishes,—and not fully, because ours are distinct and separate kinds, peculiar to our waters, and not found elsewhere. It is true, if we should judge by the names, we should at once infer that we have plenty of the same fishes. We have the trout, we have the pickerel, we have the eel, we have the white-fish, we have the bass; in fact, all our fishes have received names which apply to fishes in Europe; but, for all that, they are not the same. The first settlers of this country, when they met these fishes in these waters, gave them the names of the fishes which they most resembled; but they did not recognize the slight differences, or, sometimes, the more prominent differences which distinguish them. You have a familiar example in some of our birds. Everyone knows that the European robin is a small bird, not larger than a sparrow, which is totally different from the bird which we call the robin, but both have red breasts, and struck by the similarity to the European robin in this respect, the first settlers, seeing a bird approaching their houses as familiarly as the robin does in the old world, gave it that name; and yet it is a bird that does not even belong to the same family among birds. So you see that in order to be successful in carrying out this new business of fish breeding, we must first study our own fishes; we must learn in what manner the trout of these waters differs from the brook trout of the old world; we must remember that even in different parts of this country there are different kinds of brook trout; that the brook trout in the high north, beyond Lake Superior, is another kind from our own brook trout; and we have to learn what are the differences in the habits of our lake trout as compared with the lake trout of Europe; we have got to learn what are the differences in the ways of our pickerel, as compared with the pickerel of Europe; and so with every kind of fish. Here is, therefore, one of the first difficulties which is to be overcome; and while following in a measure, the indications of those who have been successsful in this business abroad, we must remember that if we meet with failure, it may very

like be owing to the difference in the habits and constitution of similar fishes in the two hemispheres.

There is another point that is of great importance. Fishes breed at very different seasons, and require, during the time necessary for the eggs to hatch, very different conditions. There is one entire family of fish, that of the Salmonoids, as naturalists call them, including the *Salmonidæ*, which all breed in the cold season of the year. They require very cold water to be hatched. Here we must accept ideas entirely different from those with which we are familiar. When we would hatch the eggs of our hens or of other birds, we know that we must submit those eggs to an increased temperature. The hen sits in feverish heat upon the egg, and by that heat she warms the yolk, the germ is developed, the chick grows, and is finally hatched. If you were to submit the eggs of the trout to a higher temperature than that of the water in this cold season, your eggs would die at once. It must be remembered that the temperature most favorable for the raising of trout's eggs, is about 40° Fahrenheit, and rather below than above. They may stand a temperature down to 32; they may even be surrounded by ice, frozen in, and yet not die; and if you expose them to any warmer temperature, you are sure to kill your whole brood.

Here is an important point to remember, in connection with the raising of that particular class of fishes; and all the members of this family are in the same predicament. To this family belong, in the first place, the salmon, then lake trout, then brook trout, and all the different kinds of brook trout. Moreover, the white-fish of the great lakes belong to this family. It looks very differently in its external appearance, and yet it has all the organic or structural character of the trout; and, like the trout, it breeds in this late season of the year, and its young are hatched under the influence of a cold temperature. I have myself made experiments upon these white-fish; not the kind which we have in our lakes, but the kind which is quite common in the lakes of Switzerland. Some thirty years ago and more, for physiological purposes, I raised some of those fishes, and I frequently, exposing them in a cold room, found them in the morning frozen up in the wash-bowl in which I kept them; and yet they would stand that perfectly well, and if the temperature was never raised above 40°, I was sure to carry those young

safely through; but whenever the temperature rose higher, they invariably died.

Now there are other fishes which breed in the spring, and which, to be hatched successfully, must have the warming influence of the sun; and yet they, too, require a certain moderate temperature. The water cannot be allowed to rise very high, otherwise they, in their turn, die; nor can it be allowed to fall very low. The temperature best suited to these fishes which breed in spring is between 60° and 65° or 70° Fahrenheit. I have not experience enough to tell you now what would be the most suitable temperature for raising pickerel, for instance, or black fish, or black bass, or striped bass, or any of these kind of fishes; but you can easily ascertain it by finding their breeding-grounds and ascertaining the temperature of the water, and then you must try to keep the temperature of your artificial breeding-pond at that temperature at which you have found the water in those places which they naturally select to lay their eggs.

Let me say a few words upon the different kinds of fishes which it may be worth while to introduce where they are not native, and what are the different conditions under which these different kinds are most likely to prosper.

In your mountain brooks, or in the little lakes into which these brooks empty, you would succeed best with trout. Trout is a fish which requires clear, cold water all the year round, and which in summer is likely to fail if the temperature rises above 50°. The colder you can keep the water in which you raise trout, the better will you succeed. In the waters of low regions, such as the sand-flats of Cape Cod, you have an opportunity for raising the black bass. That fish will stand a variety of exposures, for it is found in the great Canadian lakes, as in Lake Huron, Lake Michigan, Lake Erie and Lake Ontario, where the water is much colder than even in our ponds during summer; and therefore that fish is capable of being brought up in a greater variety of exposures than many others; and as it is one of the most delicious fishes, and grows rapidly, you have the opportunity of producing here a valuable article, in a comparatively greater number of localities, than many others. I think that that is one of the most valuable fishes which can be intro-

duced into Massachusetts. It has already been introduced into a great many localities, and it is prospering very finely.

Another point to be taken into consideration, in order to be successful, is the selection of the breeding animals. Trout will grow larger in large brooks, and they remain small in the smallest brooks ; and in proportion as they are naturally large, they will produce more rapidly an offspring which will grow fast. I would therefore advise those who establish breeding trout-ponds to secure trout from those brooks where they are largest, in order to be very rapidly successful, and to introduce into their ponds a breed which is of rapid and large growth. These are just the same principles that you would follow in the selection of your cattle. If you were to breed for beef, you would select such breeds as grow large. If you have another object, you will of course be guided by your intention ; and so, in breeding fish, you must look to the objects you have in view. Here, for the present, you can hardly have another object than a large production and rapid increase ; and, in order to secure that, you must provide for additional food. Your breeding-ponds will not naturally produce a sufficient amount of food to secure the rapid growth of your fish. You must feed them just as you feed your cattle. You must feed them regularly, and you must give them a variety of food. They get tired of the same food ; they like a variety, just as much as we do ; and if you do give them plenty of a variety, you are sure to secure a satisfactory result ; but if you do not provide for a supply of this additional food, you will be disappointed. I saw, last spring, to what extent the difference may go. Trout which had been bred from the same spawn were put in two different places, and in one locality left to shift for themselves, without much care, while in the other they were fed plentifully, and with a variety of food. In six months there was a difference which was astonishing. The one set of trout had not grown to more than two and a half inches in length, and weighed hardly an ounce ; the other had grown seven inches in length, and weighed over six ounces. We have here an evidence of the beneficial result arising from proper care.

As I cannot enter into all the trivial details, where the question is to guide your first steps in a new enterprise, I would say that the intestines of sheep or any other animal killed at our

slaughter-houses will be particularly welcome to trout, and can be obtained at a trifling expense. You need not be very nice. A piece of liver or any of those organs which are not fit for the table, if hacked to pieces, will be a delicate morsel for your fish. Adding to that, sheep dung, you will have a variety of feeding materials which will secure the rapid growth of your fish.

There is another point which ought to be taken into consideration. It is, that some fishes are inimical to one another; they will not prosper if they are kept together in the same pond. The pickerel is very voracious, and though it is a fish which in certain circumstances would be very desirable, and which grows very rapidly, if you introduce it into your trout pond, you are sure to see your trout diminish in number rapidly, and perhaps be entirely destroyed. The black bass is also a voracious fish, but not so much so as the pickerel. It might be brought up in the same pond with trout, provided you supplied the pond with a sufficient amount of food, and that of a kind which shall be preferable to the eggs or the young fish. Then you must take care that what is not eaten up does not remain to infect the water. You take good care to keep your stables clean; you do not allow your cattle to remain crowded in dirty places; you give them a fresh bed as often as is required. So should you see that the bottom of your trout pond is kept nice. And as you cannot do that well yourselves, it would be best to introduce into such ponds fishes which will feed on this offal; for instance, suckers. They are the best helpmeets you can secure for that purpose, for they will feed on that which is not taken up by your trout. The trout feeds always upon food which is suspended in the water. It does not go to the bottom and does not search for food by turning up stones and looking at every object which is at the bottom; it darts at its food as it comes down in the water; and therefore, when you feed, you ought to feed slowly, and you ought to feed over a large surface, so that the trout shall have room to come up to their food and snatch it up before it reaches the bottom. When it has gone to the bottom, the trout will no longer make use of it, or only to a very limited extent, but you may introduce a small kind of suckers, which may themselves become an article of food for the larger fish, and in that way secure the useful result of keep- your pond clean and furnishing a proper supply of food for all.

There are a few animals against which you must guard. Wherever muskrats are common, you should not build artificial breeding ponds, or you should at least begin by exterminating them, so that the eggs of your breeding fish shall not be destroyed. Muskrats are very large feeders, and they relish particularly the eggs of fishes, so that they are one of the most dreaded inmates of our fish ponds. Frogs, also, must be hunted down, if you would be successful in fish breeding. These are the thorns and thistles of our field, and we must weed them out, if we would have a clean field and make a good crop. All these particulars will be suggested by the different localities.

Then another point. The same water can be used over and over again. Because your neighbor has a successful pond upon his farm, do not think you cannot have one equally successful, a few rods lower down. That same water will turn your fish mill just as the water power will turn your grist or saw mill, and that of your neighbor above or below. Therefore, there is no end to the extent to which you can introduce this artificial breeding of fish.

I think these are the most general principles upon which you may establish fish breeding. The manner in which this is best to be done will depend upon the kind of fish you propose breeding, upon the exposure of your sheet of water, upon your surroundings, upon your opportunities, and it would be tedious were I to attempt to describe more fully these particulars. There are already a number of publications in which the results of the efforts thus far made are described, and I would recommend to all those who are interested in the subject the reports of the State Commissioners on Fisheries, written by Col. Theodore Lyman, in which there is a vast amount of valuable information on that subject.

Now, let me say a few words concerning the growth of the fish themselves, and some of the circumstances which accompany their growth.

The first condition for successful breeding is to secure ripe eggs, and they are known to be ripe when, on taking the fish out of the water, it lets the eggs go in a stream. Taking such eggs, you are sure to have them in the condition favorable for breeding. They ought to be placed at once in localities where

they will be secure from all those circumstances which might injure them. They must at once be supplied, if they are trout eggs, with a stream of water which will be constantly renewed, and constantly maintain a low temperature. And you must, if possible, avoid one great source of loss among these eggs, which is found in a minute little plant, known as water-silk, which consists of threadlike growth, of about the thickness of the finest silk thread, of a greenish color, and which multiplies very rapidly in some waters. In localities where that vegetation is abundant, there is little chance of being successful, because the seeds of the water-silk, which are exceedingly minute, floating in the water, will adhere to the eggs, root in them, and very soon kill the germ of the fish. There is only one way to obviate this difficulty, where it is in a measure inevitable. It is to place the eggs in such a position that the water which flows upon them will keep them revolving, and not allow them to remain stationary upon the bottom. That is one very important point—to have the water flowing over the eggs in such a manner that they are more or less kept in motion. The flow of water should be sufficiently strong to disturb the eggs from their position, and make them rise and fall. If they are raised too much, they may be carried along; but if they are only raised slightly, they will then just be in a position to avoid the deposit of the seeds of this vegetation upon them, which destroys them so rapidly.

The covering of the eggs with the milt is of course an indispensable condition for the fecundation of the eggs, and when they have once been fecundated, the process of growing goes on gradually and steadily. At that time, the eggs are perfectly transparent. The moment you see an egg turn opaque, you may be sure it is dead, and the sooner you remove it the better, for it will decay and become the cause of infection, and therefore ought to be removed. As long as the egg is alive, it remains transparent. Even after the young fish is formed, and when it has reached a considerable stage of progress, it is still transparent, or it has such a lively color that it shows by its very tint that it is alive.

[The Professor proceeded to show, by the use of the blackboard, the process of the formation of the fish in the egg, representing its appearance in the various stages of development.

The curious in such matters will find the whole process very fully detailed in Prof. Agassiz's work on the *Salmonidæ.*]

The salmon egg requires from seventy to eighty days before the young is hatched. Our trout take a few days less, perhaps seventy-two or seventy-four, according to circumstances. You will find that some trout are hatched sooner than others, varying perhaps by a week, but over two months is always required for these fishes to be hatched ; and yet there are others, such as our bream, which will hatch in four days. There are other fishes whose eggs require even a shorter period of incubation ; so you see at once how important it is that you should make different arrangements for each particular kind of fish. I do not know how long the pickerel takes here. In Europe it takes about three weeks ; the perch, about twelve days. I have no doubt that it will be found that each of our different kinds of fish has a peculiar period of incubation, so that for each, we shall have to provide food for the young in due time, for they are particularly greedy after they have absorbed the yolk.

I have some young trout so far advanced that you can see their eyes by the use of a magnifying lens. They are objects of great interest and curiosity. I think these things ought to be taught to everybody. We have introduced into our schools lessons in physiology. What do they consist in ? In committing to memory what the text-book says upon the subject. Instead of that, why should not the teacher, since we can raise fishes without number, show to the school-boys and school-girls, with a small lens, which can be bought for two or three shillings, these processes of growth ? They would then know how they grow themselves, for we grow in exactly the same manner. There would be a lesson in physiology worth having, because it would not be words, it would be living images of the living being, resembling our own form, at that age, in a manner which is astonishing. That is what I would recommend, that the community should grow up to an understanding of what may now be expected from teachers, and demand such teachers as can explain these things to every one. There is no difficulty in it. The means of exhibiting the growth of fishes, for instance, are not so expensive as the apparatus now in use in our schools, and that would, as I say, be the best preparation for the proper conduct of life, as far as the regulation of our diet

is concerned. We should know how we are made, and should be able to appreciate for ourselves what are the conditions of life; and these may best be learned from a living creature.

The PRESIDENT. I know I do but express the feelings of this assembly, when I say that the lecture to which we have just listened has afforded delight and satisfaction to every one present.

THOMAS COLT, of Pittsfield. *Mr. Chairman and Gentlemen of the Board of Agriculture,*—The farmers of Berkshire and the citizens of Pittsfield have listened with the greatest pleasure and satisfaction to the addresses and discussions that have taken place during the last two days. In their behalf and in their name, I tender you, sir, and the gentlemen present, members of the Board, their heartiest thanks. It is about sixty years since the farmers of Berkshire became alive to the necessity of improvements in agriculture. It was in this county and in this town that they first formed themselves into an association by which they hoped to improve agriculture by exhibitions and competitive premiums. That society has gone on increasing, from that day to the present, in strength and in success. Every successive year has been its best, and at no time during its existence has it been more prosperous, or more successful, or more efficient in accomplishing its purpose, than at the present time. The president of that society called them together here to meet the Board on this occasion; they have been present, and have testified, by their attention to the lectures, by their interest and participation in the debates, how much they value the meetings of this Board. I have no doubt, sir, that they will carry home with them what they have heard here, and that the precious seed which you have so liberally scattered will bring forth its fruit through the whole county.

I regret, sir, that the Board has come here at a season of the year unfavorable, somewhat, for getting a good opinion of the county. I know that, by the rules of the Board, they meet only in the winter; but I desire such gentlemen as have not been here before to know that under this blanket of snow lie fertile fields, rich hillsides, fruitful mountain-tops, even; and if they could go through the barns of our farmers, they would have evidence that the whole county is a fruitful garden; not

so fruitful, perhaps, as the richer counties of the eastern end of the State; and yet, if the Board could see what the farmers of Berkshire have wrung from these hillsides, naturally barren, they would believe that they have good farms and know how to till them. They would see in these barns heaps of grain, tons of hay, fat cattle, and every evidence of successful farming.

I thank the Board for coming so far, and I thank them for coming so universally. Especially do I thank the chairman of this meeting, whose name, in connection with the branch of horticulture on which he has spoken to-day, is known all over the world. None more celebrated than he; none more successful than he; none more capable of teaching than he; and it is owing to his efforts, in a great measure, perhaps as much, if not more, than to those of any other man, that the gardens all around us are filled with fruit-trees, that every man enjoys what used to be a luxury, and that fruit, once so rarely found except on the tables of the rich, can now be seen in nearly every shop, and sold at a comparatively moderate price.

I thank the distinguished gentleman who has spoken to us to-night; a gentleman who put aside the brilliant offers of a court which rewards the scientific men who come into its precincts with the highest honors, to remain here, that he might teach us, as he has done to-night, how to cheapen food. I thank him for coming here to teach us this thing.

In behalf of the farmers of this county I return these thanks, and in behalf of the manufacturers I return these thanks; for manufacturing is no small item in Berkshire County. I thank the Board of Agriculture that they are teaching the farmers of Berkshire how to increase the products of their fields. Increase of production means cheap food; increase of fishes means cheap food; and not only cheap food, but good health. I thank the professor for teaching us how to cheapen food; for cheap food means cheap labor, cheap labor means greater production, greater production means cheaper articles of consumption, and greater profits to the manufacturer.

Gentlemen,—I can only add to my thanks the ardent wish that we may have the pleasure of again seeing these gentlemen here, and listening again to those teachings which we have heard with so much pleasure and so much profit.

The President. It is not my province, ladies and gentlemen,

to answer for the Board of Agriculture, but I happen to occupy the chair this evening, and I cannot allow the kind words which have been uttered by my friend to pass unnoticed. In a word, I will return to him, in behalf of the Massachusetts Board of Agriculture, our sincere thanks for his kind expressions. We hope sincerely that all his wishes may be realized, and that we may again meet on these hills of Berkshire, which, as he has truly said, are clothed with verdure to the top.

Adjourned to Thursday, at 10 o'clock.

THIRD DAY.

THURSDAY, December 9, 1869.

The Board was called to order at 10 o'clock, by Col. WILDER.

Dr. DURFEE, of Fall River, was elected president for the day, and Col. Wilder, in introducing him, said:—

Dr. Durfee is well known to you and throughout the State as one of the most faithful and enterprising members of the Board. He is the treasurer of the Agricultural College, and not only that, but he holds a treasure-bag of pretty large capacity in his own right.

Dr. DURFEE. I cannot but say, gentlemen, that I am very happy to meet you on the hills of Berkshire. I have taken some pains to come this distance, because I knew I should be well paid if I did come here. I know something about the agricultural spirit prevalent in this section of our State, and by coming here I wanted to let you know that we have an interest in this great subject in the southern and eastern part of the State. I have had a very delightful time since I have been here, and have not been disappointed in my anticipations.

I have known, as I said, something of the interest manifested in agriculture in this section of the Commonwealth in years past. I was once here as a delegate of the Board of Agriculture, and I had then a fine opportunity of seeing what you were doing and what you were disposed to do. This subject is one in which we all, through every part of the Commonwealth, ought to be interested. My friend has alluded to my position as treasurer of the Agricultural College. I do hold that position, and I am looking with extreme anxiety about these

days to have some of you come and fill that treasury up. I assure you, it is pretty much exhausted at the present time.

The good old State of Massachusetts saw fit, in her wisdom, to give us fifty thousand dollars last winter, and I hope you will all feel interested enough in the college to do what you can to induce the coming legislature to give us another fifty thousand dollars, which I think justly belongs to us. This Commonwealth has adopted the college as her own, and certainly I should be ashamed to adopt anything of so much importance and then leave it to take care of itself.

Col. STONE. It is not an adopted child; it is a legitimate child. It is the only child Massachusetts ever had.

Dr. DURFEE. Yes, sir, and she is solemnly bound to provide for it, according to her own laws.

But I will not detain this audience this morning with any protracted remarks. I believe the first business this morning is a lecture from our good friend Prof. Stockbridge, who is, I can say, a fair representative of the Massachusetts Agricultural College, and I want you to receive him as such. I therefore take the liberty of introducing to you Prof. STOCKBRIDGE.

THE ROTATION OF CROPS.

BY PROF. LEVI STOCKBRIDGE.

The great effort of a majority of the cultivators of the soil, in all countries and in all ages of the world, has been, apparently, to grow large crops perpetually without returning to the land the elements of plant-growth carried away. In all countries, and under all circumstances, the result has in the end been a failure. The soil and its owners have alike come to poverty, and migration to new and unspoiled fields, to secure the means of sustenance a necessity. With this fact written indelibly on the page of history, men have not in this regard become wise. The generation of the present, instead of profiting by the experience of its predecessors, has followed in their identical footsteps, repeated their blunders and with identical results. By failure of crops, by deterioration and poverty of soil, they have not learned that large crops deplete the soil more rapidly than small ones, that he who sells his crops, sells his land, as surely as he who conveys it by deed of warranty.

And more than this, that while the measured acres remain the same and tax him as a part of the property of the nation, the elements of plant-food which alone gave it value are gone, and the land incapable of making return for its maintenance. It is not the ages of long ago and the old world alone, that this vain attempt has cursed and ravaged. But with the first settlers the experiment was renewed on the fertile virgin soil of the new world, and in due course of time with the same inevitable result. The rich lands of all the Atlantic States, which to the early settlers yielded the most bountiful harvest, even under imperfect cultivation, succumbed to the process, and do not now yield food sufficient to feed their people. The plague has already reached the prairie and alluvial farms of the near West, and its ravages are distinctly marked in the rapid decreased production of all the cereals; and I fear is destined to spread, and speed onward, until it shall meet its kindred wave sweeping inward from the Pacific shores to the summit of the Sierra Nevada. It is not that intelligent men have not known that this process was going one, that its progress has not been stayed. The Hebrew, the Grecian and the Roman in their day saw it clearly, deplored it, and endeavored to devise methods by which its results could be averted. The German, the Frenchman, the Englishman, and the Anglo-Saxon on American soil, have combated the destructive practice; but the great wave of the majority has pursued its course, but little hindered by the warning voice raised against it. The wealth and prosperity of the nation is measured by its annual crops; and the question, how shall this devastating tide be stayed, becomes one of supreme national importance, equalling, if not overtopping, those of tariff, internal improvement and currency; and should receive the serious attention, the anxious thought of the statesman and patriot. The great question for us to solve is: can our American soil be made to retain its fertility, its power of producing crops, the food of our own people, and of the millions who are crowding to our shores from every quarter of the globe, unless its annual crops are returned to it, to preserve its capacity of production? The question, though one of national import and importance, addresses itself with peculiar force to every individual man who guides a plough or harvests a crop. Drops make the ocean no more than our individual crops, and

the power to produce them perpetually, make the mighty aggregate of the nation's present and prospective income.

The great object of cultivating the soil is to produce plants. But plants are not produced by a mysterious power from nothing. They are formed in accordance with natural law out of materials previously created and deposited in the soil and in the air. Plants, animals and soil are of one and the same material, simply changed in form, composed alike of the organic substances, carbon, oxygen, hydrogen and nitrogen, and of the inorganic substances, potash, lime, soda, magnesia, oxide of iron, oxide of manganese, phosphoric acid, sulphuric acid and chlorine. It is a mistaken notion that this great earth, with its thousands of square miles of soil of unknown depth, is one great reservoir of plant-food, on which they may grow to perfection, be removed, and the supply remain exhaustless. Not one thousandth, or one ten-thousandth, of this great mass of earth is in a condition to feed plants or to be transformed into animal structures; and that small portion has been made so by the most slow and obscure of chemical and mechanical processes. In this view, this soil which we tread so carelessly beneath our feet, and which to the unthinking millions is simply so much dirt, becomes one of the most wonderful and mysterious compounds; and the changes through which it passes, in its transformation from the rough, raw earth to plants and animals, and the laws which govern, which accelerate or retard, at any point of the process, should, if possible, be understood by the tiller of the soil. Pulverized granite and sawdust, mingled, would contain all the elements of plant-food—would be soil made up in due proportions of organic and inorganic matter—but it would not nourish plants, for the elements are not in an assimilable condition. And this is precisely the original state of the soil we cultivate—the state to which we can again reduce it by removing the solvent portion. It is necessary that the sawdust should be reduced to carbonaceous matter to give to this soil color, absorbing and retaining power, to give it porosity, and some portion of organic plant-food. It is necessary that the pulverized granite should be taken to pieces; its lime, its potash, soda and phosphates should be released from the affinities which hold them bound, and by chemical influences, be brought to such a condition as to be solvent in water. Then,

and only then, does this soil contain plant-food, or possess the capacity to nourish and grow plants to perfection.

It is so with the soil of our fields. Incapable of producing plants when brought out of chaos, great powers, forces and principles were started into activity to make the necessary change. Silently and unseen, but surely and incessantly, are these agents accomplishing their appointed work. The frost of winter, with its crushing, disintegrating power, is reducing the rock-particles to powder to prepare them for the more efficient action of its co-working agents. The heat of summer is decomposing the organic ingredients, and giving to the soil gases and acids for their secondary work. The air is permeating it with its oxygen to form acids, and corrode and take to pieces its metallic elements; with its carbonic acid and ammonia to unite with other acids or alkalies in the soil, forming new and needed compounds. The moisture of the atmosphere is condensed to rain, and, descending to the earth, carries into the soil its gases for plant-food, and dissolves the material prepared by the other agencies. Year after year, in an unceasing round, these influences work on, fitting the crude earth for plant-food; and when under the hand of nature alone, laying up great accumulations of it for future use.

Nature's processes are enriching, but never exhausting; and the plants which nature causes to spring up are simply agents in the good work. They send their rootlets through the soil, gathering its mineral elements when made solvent, and storing them up within themselves; their leaves into the fertilizing atmosphere, and gathering from it its carbonic acid and nitrogen; and when all are gathered, and the functions of plant-life cease, carry back all they took from the soil, with the addition of what they derived from the air. Crop after crop, in annual succession, repeats the process. When decomposition takes place, the carbonaceous matter seizes and holds securely all these materials from being washed out by the falling rains, or carried away by the searching air, until the plant shall seize and appropriate them to itself. Thus plant-food, under the hand of nature, is produced and stored up; produced faster than is needed, and laid away for a future emergency. That emergency comes when the soil passes under the hand of man, and is made to produce food-yielding plants, which are removed

to support animal life. So far as the plant-food accumulations of the soil are concerned, the circumstances are now all changed. True, nature is not dead or idle. All her forces work perpetually, and are doing their appropriate work; but the power of the plant to consume is greater than the power of production, and it not only consumes in a single year all the food produced in the year, but a portion of that which the soil had accumulated, and, when removed, depletes it thus much of its store. In a new soil, where this store is large, the process may go on year after year; in rare cases, may continue a quarter of a century, with no diminution of the crop. But sooner or later the end will surely come; the store will be exhausted, the crops cease to pay the cost of cultivation, and the land to such a cultivator is worthless. Leave this destroyed soil to the care of nature, and it will in due time be again made fertile by the original process. This is the method pointed out by the great Hebrew law-giver: "Ye shall not deprive your land of its Sabbath's"—rest, that it may recuperate. The English fallow, in all its forms, is but an imitation of this great divine law; but, in the changed circumstances of the world and its population, will not meet our wants. The unceasing calls for food of a dense population require a process quicker and more efficient. We therefore resort to expedients to accelerate and make nature's methods more powerful, by cultivating and stirring the soil, changing its mechanical texture, and opening it to the perfect action and influence of natural law. But while the cropping process goes on, this is inefficient, for the plant carries away faster than the powers of production can develop.

We now resort to an interchange or rotation of crops to secure or aid us in securing the desired result. There are several natural laws which seem to indicate that this process may be effectual whatever may be the teachings of experience in the matter. And first, nature seems to adopt a system of rotation in her forest growth, where the elements of plant-food taken away are not all returned again until after scores of years, or perhaps for centuries. The pines or fir trees on immense tracts in Northern Europe, in Switzerland, and along the Rhine, have died out, and a hardwood forest, luxuriant and strong-growing, has taken their place. In our own country large sections can be found where the hardwood trees seem to have become pre-

maturely old, have gone to decay, fallen to the earth, and their places supplied by the pine. A ripe forest of either kind removed by clearing, and the soil left to nature's working, will in due time be replaced by one different from that which first occupied the ground. This fact is not the result of chance, neither is it because the soil is worn out and destitute of plant-food; for the second growth is strong and rapid, indicating that it is well supplied with nourishment, but it points to our second great law for rotation. Plants of different kinds and species do not require for their perfect development the same kind or quantity of food material. We have potash-plants, plants which, though they partake sparingly of nearly all the other mineral and of the organic elements in the soil, will not grow and mature satisfactorily unless they are well supplied with potash in a soluble form. So, too, nature has provided the lime-plant, the soda-plant, plants that delight in phosphoric and sulphuric acids and their salts, and plants that do and that do not require the stimulating, forcing influence of abundant nitrogen. Therefore, it is that on a soil which is new or has a large accumulation of plant-food, we may grow a potash-plant year after year until the leading element of its nature becomes deficient, and its yield depreciates, and then follow it with a lime-plant, which may flourish as if the soil had never been cropped. That, with a plant requiring some other as a leading element, and so on, the entire round of plant-food, and the whole round give us paying crops. Or we take any plant we choose at regular periods, and rely on the processes of nature that are perpetually at work in the soil, to develop a sufficient supply of its predominating element during the interval of its absence, to give it a luxuriant growth when it shall be returned to the soil.

But again, leaving out of sight all the pros and cons of the disputants over the excrementitious theory; the theory, that plants can make no choice in their food, but must, and do, take up in their sap everything in the soil that is soluble, and retaining only such in their growth as is agreeable, but returning to it as excrements the remainder, and after a time poisoning it, or rendering it unfit to nourish that class of plant—though after decomposition some other plant would thrive on the discarded material—it is certain that observing, practical men,

especially those who are accustomed to observe plants in house and pot-culture, recognize in nature something akin to it in a large number of plants, and can secure the highest success in their vocation only by a change of soil periodically, or a change of crop when the plants shall indicate that deleterious influences are at work. Nature is as regardful also of the physical, as of the chemical condition of the soil, and the two influences are in her working intimately united. Chemical influences are ineffective unless the physical state is such as to bring it fully under their power. Plants growing on the soil have great influence in this regard, but some much more than others. Some give the soil shade and protection from the influence of the sun and wind, retarding decomposition, aiding carbonization and preserving its moisture. Some send their feeble rootlets to but little depth, and only in the friable earth, while others penetrate, and by their expansive power open the soil to great distances, bring up the fertilizing material from below, fill the whole soil with their fibrous network, and then by decay give to it large quantities of organic material to impart color, absorbing and retaining power to the whole mass. A change of plants enables us to secure these different influences as the soil shall require them to assist the chemical forces in the more rapid development of plant-food.

I have thus endeavored to indicate some of the natural laws which point to crop rotation as one of the aids of which we may avail ourselves, to preserve or improve the producing power of the soil when the crops are removed for animal sustenance. But science and practice both completely demonstrate that they are only aids. No system of rotation has ever yet been discovered, and I have grave doubts if it ever will be, that will enable us to remove annual crops from the soil without depleting it. We may grow a potash-plant until it will grow no longer, and the soil is specially exhausted, for that class of plants. Then we may take the lime-plant and so through the entire list of special feeders, and at the conclusion of the round we shall find a soil suffering either from general exhaustion, or so deteriorated as to scarcely pay the cost of cultivation. English farmers, amateur and practical, have tried crop rotation as a cure for sterility a whole generation with the most unsatisfactory results and with an endless diversity of opinion as to

what the rotation shall be and what its results. White-root and leguminous crops have all had their place and advocates. They have tried it on the two years, three years, four years and up to the eleven years rotation, with clean fallow and without, with turnip fallow, fed from the land and without, and the result is, no rotation is successful in preserving the capacity of the soil, unless at short intervals in the course it be well supplied with manure. Where the circumstances of nearness to markets and good supplies of manure favor, the true position of the farmer is, to consider himself a manufacturer, with the land as his machine, and his manures as the raw material which he is to manufacture into such plants as his market requires. To such a man a fixed system of rotation is of little account. His only care is, to so abundantly supply the raw material as not to work up his machine (that is the soil) into his manufactured product, thus destroying its power of producing the largest quantity and of superior quality. Under other circumstances, as where the farm is removed from markets, and the sources of manurial supply; where it is necessary that its producing power should be sustained from its own resources and those of its cultivator, a well settled intelligent system of rotation, a working together with the elements and principles of nature to sustain the fertility of the soil, is necessary. But what can crop rotation do for the farmers of Massachusetts, and what shall that rotation be, are the practical questions which it is needful for us to solve.

I answer, first, rotation can aid, and only aid, those farms which circumstances require shall be self-supporting so far as preserved fertility are concerned. No system of rotation can be devised, as the best for all the circumstances of soil, climate and market; but a system must be adopted to comport with all these varying circumstances, with the tastes of the individual, and the home wants of the farmer's family.

The circumstances of the country are such at the present time, and probably will be so in the long future, that the three great leading agricultural pursuits of our people should be, the growing of vegetables, small fruits and garden products for a home market; the growing of dairy stock, and the production of all dairy products, and the cultivation of tobacco. A large portion of the farms of Eastern Massachusetts, as well as those

in other parts of the State that have quick, cheap transportation to our cities and populous centres, can be profitably used in the production of small fruits and vagetables; and but little rotation is allowable, except in some of the more distant sections, where manure is costly or not easily obtained. In such sections the crops more commonly produced are early potatoes, cabbage, pease and turnips, and the soil should be a warm, sandy loam, with a small per cent. of clay. Now these crops are enormous feeders, and take from the land its mineral and nitrogenous elements with great rapidity, and require large returns of the best manure. A crop of twenty tons of cabbage would carry off seven hundred pounds of soluble mineral matter and a large portion of nitrogen. A crop of turnips of seven hundred bushels would take off four hundred and ninety pounds of mineral matter. A crop of two hundred and fifty bushels of potatoes to the acre would consume five hundred and thirteen pounds. This is a rapid drain of the land, and nature's forces can do but little towards supplying the loss. Now wheat, with a crop of twenty-five bushels per acre, carries away but twenty-eight pounds of mineral food, and its needed nitrogen if the straw is left; and barley, with a crop of forty bushels, removes but thirty-six pounds. Red clover, with a crop of two tons per acre, carries off but fifty-seven pounds. And while the former crops take up in their mineral matter an enormous per cent. of potash, the leading special ingredient of the latter is lime and the salts of lime.

A rotation, by which these crops could be grown successfully without a constant supply of barnyard manure, would be, first, potatoes, a potash plant, treated with a mixture of wood-ashes and plaster. Second, wheat, a lime plant, or Indian corn or barley, which would take nearly the same ingredients as wheat. Third, turnips, a potash plant, with yard manure. Fourth, cabbage, treated with phosphate and sulphate of lime, and some compound of nitrogen. Fifth, clover, the second crop of which should be ploughed in, to prepare the land for the succeeding potato crop. This change of crop will change the want in the predominating element of plant-food, will make but one draft on the barnyard, supply three vegetable market crops, and two much needed crops for home consumption.

Many a farmer in our eastern counties, with a majority of

those on the hills of Worcester, on the slopes of the Connecticut Valley, and on the mountains and vales of Berkshire County, must produce dairy animals and products. The effect of this branch of farming on the soil is to carry off rapidly the salts of lime, together with other mineral and nitrogenous elements, in the carcases of the animals and in the milk, cheese and butter sent to market. The latter product, butter, is the least hurtful of all, as it carries away little but carbon, which can be easily and cheaply supplied. A butter-producing farm can be kept in high tilth, with less expense of thought, care, cultivation and manure, than any other; but milk, cheese and cattle-selling farms must have the constant drain supplied, or they will soon deteriorate. The crops necessary or desirable to be grown in such husbandry are the grasses, grains and roots, and require a strong and retentive soil. Hay is the staple crop as food of the cattle, (though when we take into account its nutritive equivalent and market price in most of the towns of the State, it is not so cheap feed as roots or Indian meal,) and it must be grown largely for that purpose. It is also one of the best ameliorating crops for the soil; therefore it should occupy the first place in the rotation. Roots are important as a change of food, to give to the animal system a healthy tone and vigor, and they give a large amount of nutrition from a small space of ground. Grain, especially Indian corn, has great sustaining power; serves to strengthen and support the animal, and by its oily richness contributes much to the rich quality of the dairy products.

Taking into account all these facts, as well as the wants of the farmer's family, the following seems theoretically, as it is known to be practically, a judicious rotation. The first year Indian corn, treated with ashes and sulphate of lime. This plant will take from the soil largely of its potash, a small per cent. of its lime, sulphur, magnesia and organic products, but will leave of nitrogen, the phosphates and other alkalies enough for the succeeding crop. It will act mechanically on the soil, as a pulverizer, to break it up and bring it into a fine, friable condition. The next crop should be wheat, rye or roots, according as the wants of the farmer require; but for the land, either of the two first are preferable, and it should be treated to bone phosphate of lime and seeded to clover. The following

year the clover and the stubble, which is strong in potash, should be ploughed in, the land heavily manured, and sown to mangolds or Swedish turnips; to mangolds, and treated with five bushels of salt per acre, if designed for milch cows; and turnips, if for horses or young, growing stock. These plants will feed more largely on potash than any other mineral, and will deplete the soil of much of that material, and should therefore be followed by a crop taking some other as its leading element. Clover is a lime plant; as a forage plant, also, it is second to none we cultivate. Whether as a pasture plant or fed in the form of hay, it is charged with the fatty, oily materials necessary to make rich milk, to cause the animal to lay on fat, with albumen to administer to the healthy vigor of the muscular tissues. Its influence on the soil is highly beneficial. It sends its strong network of roots deep into and all through it, searching out and bringing up plant-food from the subsoil, which other plants could never reach; sending out its numberless leaves to gather and appropriate the fertilizing elements of the atmosphere, and when its life is ended, leaves the soil open and porous and filled with the richest of organic and mineral material in its roots. Clover, then, should be the crop the fourth year, and it may be either pastured or mown from the field; and according to the circumstances of the farmer and the physical condition of the soil, as to whether it is light loam or strong and retentive, it may be continued in clover and grass one, two or three years, when the rotation can be commenced again with Indian corn. In case it is designed that the land shall remain in grass three years, other grass seeds should be mixed with the clover at the time of sowing; and if the rotation is to be recommenced after one or two years of clover, the second crop should be ploughed in. This rotation and mode of management will give us at least four good and profitable crops, with but one heavy draft on the barnyard; but the soil is much strengthened by the minerals applied and the organic substances ploughed in, and will in time be found to increase in productiveness.

The next great agricultural pursuit of our people is tobacco culture. Right or wrong it is a fixed fact that more than five thousand acres of the best land in the State are devoted to this crop, and they produce an annual value greater by far than all its market gardens, and nearly equal to that of all its dairies.

I can hardly in this regard endorse the sentiment of him who said, "Whatever is, is right;" but the fact is here, and I have to deal with it now only as an agricultural question. The tobacco-plant is an enormous feeder of all the elements of plant-food, but especially of potash, the various salts of potash, and the organic element of nitrogen. It also requires a fair supply of lime, and a soil of fine physical texture, open, retentive by the power of its organic matter, rather than by that of its clay. Tobacco being the product ultimately sought as the market product, its cultivator needs only hay and grain as adjuncts to its cultivation, to supply the needed fertilizing material and a few products for home family consumption. A tobacco farm cannot well produce this crop, and large quantities of grain, especially of the coarser kinds. These must therefore be purchased of those who are bound to sell them at the West, but the hay must be produced at home. Science fully demonstrates, from the feeding nature of the two plants, (and practice has over and over again verified the demonstration) that tobacco and wheat are the plants which should follow each other on the same soil. Wheat thrives hardly so well anywhere else.

The rotation in this culture, taking into account all the circumstances surrounding it, should be tobacco, wheat and clover. First, tobacco not less nor more than two years and treated to barnyard manure and some form of potash. Two years, because one year is not sufficient to bring the soil into that fine tilth essential for the best quality of the crop. Not more than two years, that each part of the farm may have in season its due portion of the yard manure. Second, wheat, and the land seeded to a variety of grass-seed, but clover predominating. The third year, clover, treated with sulphate of lime. Fourth year, clover and herdsgrass, after which the rotation can be recommenced. This rotation gives us five crops, the three last of which, at least, are highly important and useful crops, and the first will give a greater clear profit than any other crop which can be as extensively grown in the Commonwealth, and has made but two drafts on the manure heap; the land also is kept in good tilth and its producing power preserved.

Gentlemen of the Board of Agriculture: I have endeavored to discharge the duty assigned me by pointing out what, in my judgment, rotation of crops can do for the farmers of Massachu-

setts, and the manner in which it should be done. Although I have spoken of but three branches of our pursuit, those which it seems to me will for years to come be our leading pursuits, I am well aware that there are many other branches of important and of somewhat extensive culture, for which a judicious rotation might be an important aid, but to make definite rules for them all would be a herculean task, and probably an utter impossibility. A few leading principles should be clearly understood, and the intelligence and common sense of each individual must direct to the true course. The principles are: first, use all the manure you can make or get, and use manure which contains *all the elements* of plant-food. Second, rotate your crops to aid in preserving the fertility of your fields, and follow your present crop with one composed of different, or of different proportions of the elements of plant-food, organic and inorganic. Third, follow the present crop with one which shall change the physical condition of the soil, or have an ameliorating influence upon it.

These principles steadily and persistently adhered to, will lead us by a broad, open highway to success. Success in the preserved fertility and producing power of the soil, and success in the pocket of the owner.

The PRESIDENT. Gentlemen, you have a very broad subject before you this morning; perhaps the most interesting subject that can come before a Board of Agriculture. The subject is now open for remarks by any gentleman present. I hope you will occupy the time.

Dr. REED, of Pittsfield. I want to express the pleasure with which I have listened to Prof. Stockbridge's lecture. I think we have had laid before us the true principles of farming. It is but a few years since a kind of vague impression prevailed among the people that plants grew by something that they derived, by some inherent power, from the elements. They knew a creature must be fed, or it could not grow, but a plant grew, and there was an end of the matter. And it is but a few years since the idea was, that rocks grew as well as plants. But those days have gone by. I was pleased with the lecture, because it appears to me that the true principles upon which we are to make improvements have been laid before us. I have no confidence

in the experiments which are made, one here and another there, because so many circumstances which are essential to test the validity of an experiment are left out that we can learn nothing from them. Look at the experiments which were made a few years ago all through the Commonwealth, to ascertain the best method of applying manure. They were a bundle of contradictions. In one place, manure ploughed in deep gave the best crop; in another, the best result was produced by spreading the manure on the surface of the land. This was undoubtedly so, and the difference in the result was owing to the difference in the land or in its situation, or in the atmosphere of the place, which vitiated the experiment, and rendered a comparison useless. I think we may find here an explanation of what seems to us so marvellous in the experiments detailed by Prof. Chadbourne.

The speaker is right in the statement that the decomposition of the earth is still going on. It has been going on for ages, not merely by the agency of air and water, but a great grinding machine of ice has passed over our rocks, it has ground them down, and the water has rolled over them and scattered and mixed the soil thus ground to pieces, and thus given us the elements of vegetation. We know that this process has been going on; we know that the ice has passed over our hills, for it has left its footprints plainly engraven upon our rocks, and there they are visible to-day, to any person who will look for them.

Sir, when we take principles, and make those principles familiar to all, we can apply them and carry them out. I have alluded to the unsatisfactory character of experiments, where a piece of land, apparently of the same character, divided into a number of lots, gave results entirely dissimilar. What is the reason? Undoubtedly, this great current of water which has mixed up the soil, has deposited in one place a little more lime, and in another place a little more potash. There is a difference in the soil, so minute, it may be, that no chemist could distinguish it. There is a reason for all these contradictory results; the difficulty is, our analyses are not sufficiently minute to show us these reasons; but if we will take the facts and principles that lie at the root of this whole matter, we shall be able to understand and appreciate the results.

Mr. Hubbard, of Brimfield. I have listened with a great

deal of interest to the address of Prof. Stockbridge, and also to the remarks of the gentleman last up. It is a fact, that when we take the experiments of different individuals, in different sections of the State, we find there is often a strange conflict between them; and it seems to me that in nothing is so much judgment required as in agricultural experiments. If a mechanic is going to perform a certain piece of work, he ascertains almost to a dollar what it can be done for, and in what time he can do it; but when we come to the farm, and want to know what it will cost to produce a certain number of bushels of corn, or so many pounds of butter or cheese, we cannot make our calculations with any exactness, because there are so many conflicting things that come in to disturb our estimates. If we can instil into the minds of the farming community this idea—that if we would take from the soil certain crops, we must supply the waste that is occasioned by the operation—we shall do something that will be a benefit to the farmer. The idea that we can be continually taking from the soil without returning anything to it, is almost the same as if a man, possessing a certain amount of property, should suppose that he could spend that property all the time and still not exhaust it. It will be exhausted; an end will come to it.

I have never been so struck with the difference in cultivation as I was when I visited the society at Greenfield, and went to Shelburne Falls and saw Mr. Anderson's farm there, and the manner in which the farms adjacent to it were cultivated. In the one case the soil was very productive; in the other it produced very little indeed. The reason was, that in one case it was highly cultivated and fed; in the other case it was neglected and starved. It brings to my mind the anecdote of the man who, when asked how he got such good crops from his fields, replied: "I *hire* my fields to produce." How can we expect our fields to produce if we do not do something for them, instead of constantly taking away from them?

The idea advanced in the lecture, that grass is an unprofitable crop, or that it is an expensive crop, did not seem to me to be true; at least, in certain sections of the State. In the section of the State that I represent,—in Worcester County and Hampden County,—the grass crop is the great crop, and it is the crop that we must rely upon to feed our stock for dairy purposes.

We cannot afford to raise corn as well as we can afford to raise grass. We can give our attention in that direction with greater profit than we can give our attention to the raising of corn for our stock. And it seems to me, also, that it conflicts with the remarks of Dr. Loring, yesterday, that we needed something different from corn for feeding our dairy stock. It is a fact well attested by those who keep dairy stock for the purpose of producing milk, that we do not want so heavy feed as oil-cake or corn-meal; and it seems to me that the great thing we must look out for in our farming operations in dairy sections is to make our farms as productive of grass as possible. As was said yesterday, grass, or something analogous to it, is the most natural food we can have for cattle.

But I hope we shall hear, on this subject, from a great many present, and therefore I will not occupy any more time.

Mr. Gold. Prof. Stockbridge has spoken very happily upon this subject of the rotation of crops, but there are other points necessary to be taken into account in this matter, which should control us, which he has omitted to notice. One is, the market value of the different crops which he proposes to introduce in this connection. He has brought out, prominently, wheat. It is a very serious question with us here in New England, whether it is a profitable crop for us to raise; whether, in fact, it is not one of the most unprofitable crops; because the West will raise it and will send it here below the cost of production even. They are determined to do that, as they are doing it now; and when they are determined to do it, is it worth while for us to attempt to compete with them in that line? It is not always so with wheat, but it is more so with wheat than with any other prominent crop. Therefore, in selecting our crops for rotation, we ought to take into account the general market value and the demand for these crops, as well as their effect upon the land and the power of our land to produce them. That is one point I would make, and it might be very extensively illustrated by a comparison of wheat with other crops.

The professor also referred to the exhaustion of the soil of its mineral elements by the growth of different crops. This exhaustion of the soil is not shown by an analysis of the crops after they are removed. The chemist shows that so many tons of wheat straw take so many pounds of mineral matter from

the soil; but the practical farmer has found out that there is some disagreement between this analysis of the chemist and his own practical results. He finds that wheat exhausts his soil more than the analysis indicates, while his cabbages, turnips and some other things which he raises are not so exhausting as the chemist represents them to be. He cannot reconcile these facts. The vegetable physiologist comes forward and explains in this manner: That these plants, during their period of growth, are large consumers—exhausters, so to speak—not of the mineral elements of the soil, (the chemist is correct, so far as the exhaustion of the mineral elements is concerned,) but they are large consumers of the nitrogenous elements which are demanded by vegetable growth, which they do not show in their matured product, and wheat is considered at the head of that list. The other grains produce the same results, in a certain degree, but wheat is deemed the highest form of food for man which we raise from the ground; the most perfect one, and we find it, in that respect, the most exhaustive. Therefore, in reasoning upon this subject of the rotation of crops, we must take into account not only the exhaustion of the mineral elements of the soil, resulting from the entire produce of the land, but also the exhaustive effect upon the land in using up the nitrogenous elements of fertility.

Still another point. The physical condition in which a crop leaves the land is an important consideration. Some lands are benefited by being left in a more compact form; some lands are benefited by being left in a lighter form. Some crops have a tendency to make the land light, others to make it more heavy. Then, again, some crops so affect other crops that it was supposed by vegetable physiologists, for a long time, that they excreted some particular element that did not allow the other crops to follow with success after them. This has been noticed by practical men, and it is an element which must be taken into account. The fact is, that the proper rotation of crops is a matter which, like a great many others that we thought we had settled a few years ago, has been brought into a great deal of doubt by the recent discoveries of science.

Prof. CHADBOURNE. I can hardly speak too highly of the very able address of Prof. Stockbridge; but I wish to say to the gentleman who has just sat down, that, so far from the West being

determined to raise wheat and sell it here for less than the cost of production, they are determined to do no such thing. They are compelled just now, the same as any man who has a stock on hand vastly more than there is any demand for, to sell it below cost. Every man knows how that is. They are carrying on a very improper system of agriculture, I grant you ; but I tell you that at this very time, when wheat in the best parts of Wisconsin and Iowa is worth upon the average only fifty cents a bushel where it lies, it is the determination of that people, so far as I can understand, to build up manufacturing establishments in every place they can and consume their wheat at home. So I tell you now, although I am a New Englander, and claim to be a Massachusetts man, that Massachusetts is able to take care of herself, and has got to take care of herself, so far as that is concerned, for the people of the West are determined to manufacture many of the articles that are now manufactured in Massachusetts, and to eat up the grain that they now send here so cheap. That is what they will do, and that is their true course, I say, much as I believe in Massachusetts. It is the secret of the power and strength and wealth of Massachusetts to-day that she has so many diversified forms of agriculture and so many forms of manufacturing industry. It is that which makes her the model Commonwealth of this earth. There is no doubt about it. Western men understand that, and while they sneer at Massachusetts, they copy her in every possible respect they can. It is curious to hear men tell how they do things Down East. They have lived at the West ten or fifteen years, and they have a notion that the West has gone on, while the East has stopped ; but let them come on and see. They will be, as one of my friends was, perfectly astonished. He said : "They are not asleep, but they have got so much money they cannot do anything." I tell you the West are determined to do no such thing ; and if you find you can raise wheat here, and can use it as a crop in rotation, I advise you to do it. Learn to raise it as cheaply as you can. The time will come, in my opinion, when you will be glad to have learned that lesson.

In regard to the carbonaceous elements in the soil, it seems to me Prof. Stockbridge provided for that in what he said with regard to clover. We do not understand the great value of

clover as a fertilizer. The professor brought it forward very beautifully and happily. It is plain that it grows plentifully; but if I should tell you the length of some roots of clover that I have seen, you would think I was drawing a long bow, so I will only say that they were *very long*. It is a rapid growing plant, and throws its roots down into the subsoil to take up the mineral elements there, while the long, broad leaves are swept across by every wind that blows. They are opening the soil and making it just what it ought to be to supply the carbonaceous matter needed by the plants. That is why he recommended clover—to supply the organic matter in the soil, which is taken from the minerals below and from the gas of the air.

It is true, one thing should be borne in mind, and the professor brought it out pretty well, that this rotation of crops actually robs the soil in a certain sense; but while you are taking one material, nature is at work storing up another from the decomposition of the rocks. I noticed one point which seemed likely to create a wrong impression, when he spoke of mowing meadows in the fall of the year. I confess I think it very likely that the conditions here are such that that is the most profitable thing you can do. I am not going to controvert that at all; I wish simply to call attention to a point which seemed likely to lead to incorrect conclusions. It was said that in a certain field a swath was mowed close in the fall of the year, and another patch right by the side of it was left unmowed, and the next year no perceptible difference was seen. I thought the inference likely to be drawn was, that therefore no harm was done by taking off that grass at that time. Now my friend Dr. Durfee was introduced as a man who not only holds the money-bag of the Agricultural College, but has a pretty deep one of his own. If he should send a check to the bank to-day for a thousand dollars, it would be honored; and if he should send another to-morrow, it would be honored; and if he should send a third the next day, that, too, would be honored; but, deep as his money-bag is, he could send his checks so often, that by and by they would not be honored. Now, sir, this grass that comes up in the fall of the year has two purposes to perform. The first is, to take the nutriment from the air and the earth and store it up in the roots of the grass, laying it up in the form of sugar and starch and other materials, to send up life in the

spring and produce flower and fruit. That is what happens to every one of our plants. The other purpose is, to act as a mulch or covering for the land. Now if, after it has done its work of storing up sugar and starch in the roots of the plant, you mow it all off, and those grass roots are protected during the winter by the snow, you will have just as much grass the next spring as if you had not mowed it. But if you take that grass off, and do not leave it there to decompose, you have taken away just so much material—you have sent one check to the bank—and your ground will not last so many years as it would if you left the grass there, any more than my friend's bank account will last him as many years, if he draws a thousand dollars a day, as it will if he makes no drafts upon the bank. When you have proved the contrary, you have proved perpetual motion; you have proved that you can take away a thing and have it at the same time. That does not prove at all that it is not the best and cheapest thing to do. If that were so, it having been proved that you exhaust the soil by taking off a crop, you might say you must never take off one. Oh, no. My friend Dr. Loring would agree that it takes off some of the material, but he would say that the best thing you can do is to take it off. I do not have any controversy with him at all on that point; but I say, you can only do that when you have your farm in a high state of cultivation. Many of our fields need every single particle of the after-math to protect the roots of the grass during the winter, and if you put your cattle in there you are doing immense harm. But if you keep up your farms as you ought, and as Dr. Loring and Prof. Stockbridge would say that you ought, so that there comes up a very abundant after-math, then you may take it off with profit, because there may be so much as to smother the grass the next spring if it is allowed to remain.

I believe fully that we have very much to learn, and all these discussions show me how much I have got to learn. But I want to repeat once more, that the West is *not* determined to sell your breadstuffs without being paid for them.

Dr. Loring. I suppose there is nothing more gratifying than to find one's opinions endorsed. There are three points that have been brought up here this morning to which I desire to allude in a slight way, and they are points upon which I have

dwelt so much, and sometimes alone, that I am gratified to find somebody with me.

The first point is in respect to growing wheat in Massachusetts. Two years ago, I occupied the time of the New England Agricultural Society at its annual meeting, in recommending to the farmers of New England the growing of small patches of wheat on their farms as a mode of providing themselves with good flour, instead of purchasing from the West. I stated at the time, that I had no doubt there was a process of wheat culture that would succeed here. I have no doubt of it. Wheat growing fell into disrepute here from two causes. One was, that the crop, to a considerable extent, failed ; and the other was, that the supply from the West was abundant. Now, gentlemen, it failed here on account of a want of proper cultivation ; there is no doubt about that at all. I am satisfied that if the farmers of New England will devote themselves to discovering the proper way of growing wheat, they can raise from twenty-five to thirty bushels to the acre, and raise it to a profit, so far as their own consumption is concerned. I think I see gentlemen in this hall who will agree with me on that point, that wheat has been raised and can be raised in Massachusetts to a profit.

With regard to wheat growing in the West, it is one of the best illustrations of the results of loose and careless farming that we have had in this country. Prof. Chadbourne tells you that the West proposes to emulate the East in manufactures, and I am not at all surprised that, after their mode of cultivating the different crops, they are turning round to ascertain, if possible, some means by which they can manufacture ; but I want them to understand, that if they make woollen goods upon the same plan on which they have been cultivating their land, they will wish all their manufacturing establishments were somewhere in Berkshire County before they get half way through with them. It is a well-known fact, established by the most careful investigations, that owing to the careless, loose cultivation of the West, the lands are becoming exhausted and worn out, and, more than all that, are becoming so overrun with weeds, that the growing of a large wheat crop upon old wheat lands is an utter impossibility.

Taking these two things into consideration, I say, let us turn our attention to the growing, not of great masses of wheat, but

of small patches on each farm, for the consumption of the farmer's own family, at least, and the supply of neighboring families with such surplus as he may have. I know there are sections where it can be grown well; the process I will not undertake to recite. The books will tell you what is right, or, if you cannot find it out in books, go to the Agricultural College, and they will tell you how to do it there.

There is another point. Prof. Stockbridge alluded to the growing of root crops. I know there are some here who do not want to hear any more from me about root crops. The introduction of the turnip into England was one of the great struggles of English agriculture. It was misunderstood there and resisted there, just as it is here. One of the earlist advocates of the root crop, Lord Townsend, won for himself the name of "Turnip Townsend," in derision, simply because he was so ardent an advocate of the introduction of the turnip crop into England; and now, my friends, from the testimony of the most distinguished farmer down to the experience of the humblest, and according to the testimony of Mr. Webster, when he visited England, the turnip crop has become the sheet-anchor of light soil cultivation throughout that whole kingdom; and I have no doubt (and he had none,) that the increase of the supply of meat in that kingdom was owing mainly to the growth of the turnip by the farmers of the realm.

Now, I want to say a few words as to the process by which turnips are to be raised. I am very much afraid that Prof. Stockbridge may have left a wrong impression upon your minds, as he did a little upon mine, with regard to this matter of raising turnips. In his statement with reference to manuring the land, he spoke of manuring it highly, and then planting either turnips or mangolds, as if they were one crop. Now, there is a discrimination to be made between the two crops. The turnip, however large a feeder it may be, detests and abhors nitrogenous manures; it will not grow well in them at all; I mean, so far as the bulb or root is concerned. You can make a turnip top as long as your arm, if you like; and you can throw all the nutriment of the soil into the neck and into the leaf, if you please, by using a large mass of barn manure. So you can select a soil that will give you a great turnip top and great length of neck, and no bulb. Take a piece of heavy clay land,

upon which you would raise a great mangold crop, and undertake to devote it to turnips, and you will fail; it cannot be done. But take a warm piece of light soil, which has been in grass for some time;—I make this point now, because the turnip is a little impatient, also, of previous cultivation; it enjoys a monopoly of what it undertakes to feed upon; it does not very well follow any other great feeding crop; it needs a light soil, which has been left in grass for years, until the grass crop has to a certain extent run out;—take a piece of light land of that description, I say, (and we all know there is enough of it in Massachusetts; there is down our way, at any rate,) light, somewhat sandy warm land, on which water never stands any length of time, plough it from the 15th to the 20th of June, put on a very little well decomposed barnyard manure,—manure in which the mineral salts have been created by decomposition before going into the soil, and out of which the nitrogenous elements have to a certain extent departed by decomposition; harrow it in; put the land in good condition, as far as you can, with the harrow; and then with a marker, make your rows twenty-seven or twenty-eight inches apart, and sow in those rows a little good superphosphate.

QUESTION. Where do you get it?

Dr. LORING. I won't undertake to say. Get it wherever you can find it. I have no doubt you can find it somewhere—

A VOICE. Make it yourself.

Dr. LORING. Well, make it yourself, if you like, or get somebody else to make it for you; but get it. It will take three hundred and fifty or four hundred pounds to the acre, sown by the hand, in these little rows. That is just about as much as you want, and it is not an expensive manure; and, remember, I am for economy in farming. Put in the superphosphate, and then sow your seed. I am particular about the season of the year. Do not put it in any earlier, unless you want the louse or the fly to destroy your plants. Sow your turnip seed in those rows, and, more than all, be sure to use a seed-sower that will cover your seed well. If you cannot find a seed-sower that will do that, put on a good solid iron roller and roll them in, and then you will be likely to get a good crop. When the plants come up, they will need a little thinning out with the hoe. They are very hardy, and you can knock them about con-

siderably without hurting them much; and in the fall of the year, from the middle of September to the first of October, (when your crop should be harvested,) it is astonishing how these roots will increase in size and weight.

That is the process by which Swedish turnips can be raised. I know there is no difficulty about it. I did not want the impression to be left here, (and I know Prof. Stockbridge did not intend to leave that impression,) that turnips could be raised upon heavy clay lands, and with large quantities of nitrogenous manures.

Mangolds demand a different soil, and will have it. You could not raise a mangold as big as a pigeon's egg in the way I have advised you to raise Swedish turnips. It would be utterly impossible. In the first place, you have got to sow it in a different time of the year. In the next place, you must supply a different kind of food. Now a few words about raising mangolds. Take a piece of good, strong, firm, well-cultivated clay land, that will retain the manure well; land that, if you put it into grass, would raise three tons to the acre, and supply your cattle with fall feed, and retain its fertility well; land on which you could raise the Marblehead cabbage at the rate of from forty to seventy tons to the acre. You can find such land in almost every valley. Plough that land early—not sod land, but land previously cultivated. Put it in as good tilth as you possibly can, and as early as you can, and plough in seven or eight cords to the acre of good barnyard manure; not diluted manure; not manure full of sand or muck or straw or loam; but good solid manure, that has got compost enough in it to hold the liquids, and no more. Put into your manure what will absorb the liquids, and no more. Let the soil do the rest. There is compost material enough in the soil itself, if you will only believe it—matter which you are not obliged to transport. Plough in your manure once, and mix it up by another ploughing. Have that piece of land well harrowed, and then drill it with a small plough, and put into those drills a good supply of salt. You had a lecture here, I understand, on salt. I wish I had heard it. I believe in salt for certain crops, implicitly. Prof. Stockbridge talks about five bushels to the acre. I have put thirty bushels to the acre for a crop of mangolds, and never got a better crop in my life. Any farmer will tell you that the mangold

is a great feeder on salt, or else the salt produces such an effect upon the manure that it enables the mangold to take it up. Put into those drills well decomposed manure, provided with a certain supply of salt—the refuse of the beef-packers or salt-fish dealers; any kind of salt will answer the purpose. We used to buy it for six or seven cents a bushel; you cannot get it as cheap now; but get it as cheap as you can, and put it in. Then have those drills smoothed a little on the top, and sow your seed as early as you can. Be sure and have it well covered. It is one of the most difficult seeds to germinate, and will not germinate unless the earth is so close about it as to retain a uniform temperature and moisture. It needs that very much indeed. Your mangolds, if treated in this way, will come well. You can get a crop of from ten to twelve hundred bushels to the acre. Much larger crops have been raised.

A VOICE. I have raised nineteen hundred bushels.

DR. LORING. On Deer Island, they report that they raise eighty tons to the acre, an enormous crop. That is the process of raising mangel-wurzel. And these two crops, properly handled, and properly used, are two of the most valuable crops to the dairyman and cattle-feeder that can possibly be raised in Massachusetts.

There is one other point. Prof. Chadbourne alluded to this matter of feeding the after-math. I agree with every word he said. "You cannot eat your pudding and have it too." Nobody doubts that. Even the treasurer of the Agricultural College cannot draw his check, and have his money at the same time. But, my friends, I said distinctly, that it involved the necessity for the cultivation of grass, just as you would cultivate any other crop. I say it is cheaper for a man, if he has got a good herd of cattle and a profitable herd,—and no man ought to have a poor one or an unprofitable one,—to feed them upon his grass land in the fall of the year, than it is to undertake to carry them over from the 15th of September to the middle of November without green feed. It is more profitable for him to do that, and cultivate his grass in proportion. Prof. Chadbourne said that it required good farming and high cultivation, and I think he said, perhaps higher than you can afford to cultivate here in this end of Massachusetts. That is not so. You can afford to cultivate just as well in Berkshire as we can

in Middlesex or Essex; the only difficulty is, that you undertake to raise grass on too much land. You can raise more grass on one acre than two, if you desire, and then you have got your land in as good condition as it would have been if you had grass on the two acres. There are two ways of managing grass land. One is, after having fed your grass land in the autumn so long that the grass crop begins to fail, give it that rotation of crops which Prof. Stockbridge has talked about this morning. Plough it and give it a potato crop the first year, if you like, but give it a corn crop the year before you put it into grass again. Grass will follow a corn crop better than any other crop in the world, partly on account of that mechanical manipulation of the soil to which Prof. Stockbridge alludes, and partly on account of the fact that it does not deprive the soil of those fertilizers which the grass itself requires. You cannot follow mangel-wurzel or turnips well with grass; corn is the crop that should precede the seeding down to grass. So far as my experience and observation in Massachusetts go, you can restore your grass land in that way, by a rotation of crops. Plough your land in the spring, and seed down, when you do seed down, not with wheat, oats or rye, but with barley. You will get a better sod, and of course a better crop. That is one way.

But grass lands are heavy, or apt to have a great deal of clay. That kind of land, if manipulated in hot weather, sometimes becomes baked. At any rate, there is a great deal of valuable grass land in Massachusetts in which you do not want a rotation of crops, as a mere matter of expense. Plough those lands in the middle of August, give them a good top-dressing, harrow in your manure, and seed them with herdsgrass and redtop, and the next spring add a little sprinkling of clover, and you can raise a grass crop just as well as any other crop. This is a good way; and although the land may be heavy, the grass comes in at a time when it is dry and easily managed.

You must rotate upon the turnip crop, upon the mangel-wurzel crop, upon the carrot crop, upon the potato crop, upon the cabbage crop;—must you upon the corn crop? How many years do you suppose a field would remain fertile in corn? A good many years, give it barnyard manure enough.

Mr. Slade. How is it with the onion crop?

Dr. LORING. The onion crop does not want any rotation. I suppose the onion, like some animals, gets accustomed to its own hole and likes it. At any rate, an old onion field is the best place to raise onions in; there is no doubt about that; and after two, three or four years, you can get an onion field so free from weeds and in such a state of fertilization, that an onion crop will almost grow there spontaneously. That is an exception to the rule. I have no doubt there are other crops that are somewhat like it.

I have made these statements because I was rather gratified at various expressions with regard to the raising of wheat and root crops. The other remarks I have thrown in incidentally.

Col. WILDER. I am very glad to hear this discussion in relation to the root crop, and I rise particularly to bring to mind a record made twenty-one years ago last September, by Mr. Webster, at the inauguration of the Norfolk County Agricultural Society, where he advocated the growing of root crops, and especially of turnips, as very important to the farmer. And whatever may have been said of Mr. Webster, in relation to his farming politics, those who knew him will stand by me in attesting that he was not only a *good* farmer, but in principle he was a *great* farmer. At that meeting, Mr. Webster made a speech which has been handed down to posterity as his Turnip speech, and he said, "Whatever may be said of England in relation to her manufactures, whatever may be said of her in relation to her success in the cultivation of crops, I take the responsibility of asserting, that without the turnip crop, England could not pay the interest on her national debt."

I did not intend to say much on this subject, but I think Dr. Loring did not mean to say that the carrot crop would not rotate well. Doctor, did I misunderstand you?

Dr. LORING. I did not allude to the carrot crop, for two reasons. In the first place, I do not believe in it much. I do not think it is a good crop for the farmer to raise. The turnip answers every purpose for cattle and horses, and is cheaper. The carrot crop, I think, needs rotation. I don't think a field will run carrots year after year.

QUESTION. Do your horses eat turnips?

Dr. LORING. Yes, sir. I feed all my young horses and driving horses with turnips.

Mr. ————. I have made it a rule to raise vegetables for my stock for ten years. I have found carrots to do about as well on the same land, year after year, as the onion does. I have raised a good crop of carrots for eight years in succession on the same land. I have great deference for the gentleman who has addressed you, but we differ in opinion.

Col. Wilder. The experience of the last speaker has been mine. I could not do without carrots for my horses. I find them a very economical article. My method of feeding is to give my horses a peck of carrots four times a week, at night, and it saves me half a peck of oats. Whether or not the carrots have an equal pecuniary value, I will not undertake to say; but I have found them very beneficial. I have never been able to make my horses eat turnips. The doctor has a faculty of doing almost everything he attempts to do, and I have no doubt, from what he says, that his horses do eat turnips.

Mr. Foote. The human animal can be educated to eat tobacco, and I have no doubt a horse can be educated to eat turnips; but I do not believe he would do it naturally.

Dr. Loring. I do not mean to go into the turnip question again, but I want to say a word in behalf of my horses. I have turned my attention a good deal to the breeding of horses. I like a good horse. I have got some good ones, and I mean to have, as long as I can raise them or find them in the market. Comparing the carrot and turnip crop, I learned by experience, in the first place, that the carrot crop was an expensive, troublesome crop to raise. I believe, my friends, in perpendicular agriculture; I do not believe in any more horizontal agriculture than you must have; you must have a little. That is, I believe in cultivating the soil standing bolt upright, and not upon your hands and knees. The carrot crop is one of those things that keep a man's nose as near to the ground as he can get it. It is an expensive crop; it needs a great deal of manure; it needs good soil and a monstrous amount of faith; and, above all, hard work. If you will insist on raising carrots, I trust and hope that some ingenious mechanic will invent a machine which will not only clean out the weeds, but fork the land over and clean out the roots for you.

Then another thing. When I came to feed carrots to my cows, I did not find any more benefit than I do—you will ex-

cuse me for saying it—from feeding green corn; not at all. It did not make any milk. It made the butter yellow; but I did not want yellow butter; I was making milk. It did not seem to be any help in putting on fat. Then I thought it was a grand root for horses. I began to feed it to my horses, as everybody said it was a good thing; but I found I had got to stop it. The hair did not look right, and yet there was the natural gloss upon it. Their legs began to look rough. It was manifest this root was affecting their kidneys badly. The discharge of urine was excessive. Then I noticed that when I undertook to drive a carrot-fed horse, I might just as well have undertaken to drive a wash-tub, and a leaky one at that. There was no satisfaction in it. A couple of miles would produce a mass of foam in front of him that was not half as pleasant as a good lathering in a barber's shop; and I made up my mind that carrots, with the exception of certain medicinal qualities that they might have to restore a horse that had been worn out with grain, were worth nothing.

Then I read in some agricultural book that the farmers in Ireland, when they began to plough in the spring, fed their horses with turnips; and I thought, "If an Irish horse will eat turnips, a Yankee horse will;" and I began to feed my horses with turnips. When I get home, I always like to take a good long drive; and if it is too stormy for that, I like to go into a stable and look a good honest horse in the face. Four years ago I began to feed my horses on turnips, taking the hint from the book of which I have spoken, and I found no great difficulty. I did have one mare, that was brought up in Vermont, and had not gone through the process of civilization on a Massachusetts farm, that objected to them; but the rest of my horses took hold of them readily. I soon found that my horses that were out of condition began to look bright; instead of their legs being storked, they would be clean and fine; their eyes grew brighter; their appetites returned. I believe there are some gentlemen in this room who have put their hands on some of these turnip-fed horses, and I would like to have them say whether they are in good condition or not. I know some of them have been kind enough to say that they drive well.

That has been my experience in regard to feeding turnips to horses. There is nothing that will make bone so rapidly, or

keep the muscle in so good condition, as Swedish turnips. For young cattle, yearlings and two-year-olds, they are inestimable. If I had a yoke of oxen that weighed 4,500 or 5,000 pounds, I should give them a few turnips to make them weigh 6,000, and a little grain now and then. But for young cattle they are admirable.

QUESTION. How much do you give them ?

Dr. LORING. A little short of a peck a day. Now you do not want to grain your colts; you cannot grain them to any advantage. Every man who knows anything about a horse knows if you begin to feed him with oats at one year old, you have lost just so much when you put him into the harness and expect him to be strong and energetic. But you can feed him with turnips and give him good hard muscle. I do not mean the English flat turnip. I mean the prince of all the roots, "Skirving's King of the Swedes." The handsomest root that grows, and the root that, if I were a young cow or colt, I should ask my master to give me freely.

Mr. FOOTE. Have you had any experience in feeding turnips to milch cows ?

Dr. LORING. I feed turnips as soon as my mangolds are all gone. I am a little considerate of my milk customers, and so I feed mangolds as long as they last. I have not heard much complaint. Now and then a customer will say, "You are feeding turnips." You cannot feed turnips and use the milk for the manufacture of butter. It is a singular fact, that the flavor will appear in the butter when it will not appear in the milk. I think you can feed Swedish turnips with some degree of safety, if you are not going to use the milk yourself.

Mr. PLUNKETT, of Pittsfield. Will Dr. Loring inform us about what per cent. of nutriment the Swedish turnip has, by analysis ?

Dr. LORING. I do not remember. I have had myself a table giving the comparative amounts of nutriment in given weights of food, but I have not carried the figures in my mind so that I can state them. We are told, I know, that the turnip has ninety per cent. of water in its composition ; but I want gentlemen to take from their tables the best piece of beef they ever had there, and press it down to a solid, and then see how much it will weigh. The amount of water that is found in nourishing

food is enormous, but precisely how much per cent. of nutriment there is in the turnip, I don't remember. The solid part is about ten per cent.

Since the meeting at Pittsfield, I have turned to the following statement made by me in 1861:—"The practical values as obtained by experiments in feeding are: of hay, one hundred pounds are equivalent to three hundred pounds of Swedish turnips, four hundred pounds of mangel-wurzel, two hundred and fifty pounds of carrots or fifty-two pounds of corn."

Mr. PLUNKETT. I believe the best authorities give the Swedish turnip about eight per cent. Then a bushel of them, weighing sixty pounds, would give about five pounds of nutriment. A hundred pounds of meal gives you about seventy-five pounds of nutriment. If you pay $2.25 a bushel, you are paying three cents a pound for nutriment. Swedish turnips, then, are worth about fifteen cents a bushel for feed. Can the farmers of Massachusetts afford to raise them, store them, and feed them out at the value of fifteen cents a bushel? For it is a money question, after all. The question is, not whether cattle and horses take it, but can you afford it? We want to know how to make money. We can buy grain in different forms. We can buy it by making cotton cloths and yarns and woollen goods. We can produce grain and meat in other forms besides raising them; but what we want to know is, how we can produce them with the least possible cost to ourselves. No doubt, we can raise great crops, but will it pay to raise them? We talk about raising carrots, but to make it profitable to raise carrots is another thing. If the Swedish turnip is not worth more than fifteen cents a bushel as food, can we afford to raise it?

I venture to say, that no practical farmer, who works himself and lives by his farm—not a man who runs a farm for the support of his farmer and to pay the taxes,—I say, no practical farmer can afford to raise these crops. We want something that a man can afford to raise—something that he can raise to a profit, and earn from his farm enough to pay for it. He must make money, and that which makes money will commend itself to the Yankee mind. Down on the Connecticut River, where they are all Puritans, you might suppose they would not do anything immoral, and yet the money argument has carried

them into tobacco. They are sacrificing all the rest of the crops to the tobacco crop. It is because there is money in it. Why should they not raise it? Somebody is going to raise it.

Now the question with Massachusetts farmers is, what shall we do to make money? Can we, with labor that costs us two dollars a day in summer, raise turnips at fifteen cents a bushel? Can we do it profitably? Mr. Webster, it is true, made his great turnip speech, as Col. Wilder says, but Mr. Webster was not a practical farmer. He could talk like an oracle on farming, he could talk like an oracle on finance, but what was the result of his financiering and his farming? Did he earn a great farm? He left no farm at all that was not encumbered by a mortgage. He spoke about turnips, and saw turnip culture in England. It is a wonderful thing there. But did he take into account the difference between labor in England and here, and the difference between the climate of England and our climate? The English farmer does not have to harvest his turnip crop and carry it into his cellar, to protect it against frost, and the cost of cutting it up and feeding it to his cattle is very much less than with us. He does it in a climate where the turnip is twice as long growing as in ours, and it contains fifteen or twenty per cent. of nourishment, while ours contains but eight per cent. And after it is grown, what then? Why, the turnip is fed to the cattle mainly on the ground where it is raised. They put what are called "hurdles" round their fields, and the cattle and sheep harvest it themselves, on the very ground where it is grown. Here is labor that costs not more than a third as much as ours, a turnip that contains twice as much nourishment, and not half as much labor required in handling it as here. Therefore, the turnip crop is more important in English agriculture than any other crop. But I say that here in New England, with our severe climate, our scarcity of labor, and the difficulty of getting educated labor, or any labor but that which you must go and stand by if you expect to have a day's work done and done right, no experienced farmer, who ever expects to pay for his farm by what he produces upon it, will ever follow the raising of turnips more than two years. I have noticed it for forty years, and I have never known a hardworking farmer to continue the raising of root crops.

But you say you must have some turnips to feed to cattle;

that it is their natural food. I say it is not their natural food. I say that God has so formed the animals of any country that they are adapted to the climate in which they are grown. You feed on dry hay in winter, and you say you want roots. Why? Did you ever know a cow or a steer or a yearling whose bowels were not in just as good condition in winter as in the summer? Why do you want to fill them up with roots, and make them just like Dr. Loring's washtub, and leaky at that? The quantity of water drank by the animal in the winter with his dry hay, is exactly equal to the quantity taken by him in the summer with his grass, less the perspiration given off in summer. The animal adapts himself to the new state of things. So that, whatever an amateur farmer may say about raising turnips for his stock, I say that any practical farmer who has got to pay off a mortgage on his farm, if he is a wise man, will not continue the turnip culture for more than two or three years.

Dr. Loring. I have but one word to say in reply to the ingenious argument of Mr. Plunkett. His point upon the labor question will apply as well to hay as to turnips. It costs a great deal of money to make a yard of cloth or a ton of hay or a ton of turnips. That is a privilege we enjoy here. The labor argument, therefore, does not apply to the culture of turnips any more than to any other crop.

In regard to the nutritive qualities of the turnip, as I said before, I cannot give the figures, but I will refer you to them in that valuable volume know as "Flint's Agriculture of Massachusetts,"—a book for the printing and publication of which Mr. Plunkett has voted an appropriation. It is law and gospel on farming in the State of Massachusetts. I do not know that the turnip is more nutritive in England than here; I will take it for granted that it is, if he says so. I agree that we must get them into the barn and feed them in the barn. I agree to all that; but still, experience is better, after all, than chemical tests in regard to the importance and value of the food you take into your own stomachs or give to your cattle. Experience is the best teacher in all these matters; and when Mr. Plunkett says you never knew an animal to get costive when fed upon dry hay, I would like to ask him if he never heard the old adage—"As tight as a yearling bull in the month of January?" That is all there is about it. A good many farmers who have

fed dry hay, and even a little corn-meal thrown in, have come to me and said that their neighbors who fed roots had a little the smoothest looking cattle. That is the testimony of a good many young, active farmers who are paying for their own farms and raising turnips too.

Adjourned to 2 o'clock, P. M.

AFTERNOON SESSION.

The Board met at 2 o'clock, Dr. DURFEE in the Chair.

The President stated that President CLARK, of the Agricultural College, who had been announced as the lecturer this afternoon, was unavoidably detained at home, and his place would be supplied by Dr. LORING.

THE FARMER AND THE COLLEGE.

BY DR. GEO. B. LORING.

Mr. President and Gentlemen,—I am under the necessity of occupying more time than seems to be my share at this session, on account, in the first place, of the amount of duty that has been assigned me by the committee of arrangements for the meeting, and, in the second place, on account of the request which I have received from the President of the Agricultural College that I would take his place in speaking upon the subject of The Farmer and the College. I suppose by "the farmer," is meant the Massachusetts farmer; and by "the college," is meant the Massachusetts Agricultural College. At any rate, I propose to confine myself to those two points, and to consider with you the relations which the farmer of Massachusetts should hold to the College, and the benefits which I conceive may arise from the union of these two forces, the practical and educational, here in Massachusetts, in the business of cultivating our soil.

This Agricultural College, located at Amherst, has been, as you all know, from its very outset, a topic of lively and somewhat sharp discussion in every part of this Commonwealth. Notwithstanding the fact that Massachusetts has devoted so much of her time and her money to the business of educating her people in every conceivable branch of learning, for their benefit and for the advancement of her own interests, the moment that the subject of the establishment of an agricultural

college was broached here, the debate began. It was somewhat astonishing, that notwithstanding Massachusetts had spent upon Harvard College, from its inception and infancy, almost down to this very hour, hundreds of thousands of dollars from her own treasury, and from the private pockets of her citizens as much more; notwithstanding she had endowed every scientific institution within her limits; had bestowed upon Williams College her bounty; upon Amherst College her bounty; upon Tufts College her bounty; and upon almost every female academy, upon the School of Technology, and upon the Museum of Natural History, a liberal share of her wealth; the instant an institution was put into her own hands for her own government and her own development, she not only began to pause herself, but her most enterprising and liberal citizens began to pause also. It is difficult, my friends, to account for this. An institution which is the only one, as you were told this morning, that Massachusetts can claim as her own—an institution which is intended for the development of the foundation of all her interests—an institution which is bound to develop that knowledge upon which the best practical farming of this State can rest—an institution which, if fully developed, will redound to her honor and her wealth as much as any other institution within her own limits, and which, by accepting the bounty of the United States and the bounty of the town of Amherst, she has bound herself to support until it arrives at its entire and full completion—is met by the most formidable opposition.

This, gentlemen, is the Agricultural College of Massachusetts—a school in which, as we believe, the farmers of this Commonwealth can arrive at what might be called a practico-scientific knowledge of the business of agriculture. I am not, however, surprised at the opposition which this institution has met with. The farming of Massachusetts has not been unsuccessful in all time past, by any manner of means. The rules that have been laid down here for successful farming have been wrung by intelligent and skilful farmers out of the very soil upon which the population of Massachusetts now treads. The best crops that have been grown here in times past are due to their intelligence and their industry. The whole development of the wealth of this Commonwealth, seventy-five years ago, was in the hands of the farmers. I doubt if at that time Berk-

shire County was in possession of a single woollen or cotton mill. There may have been, at the time that Elkanah Watson gathered his little band together here on this village green for the purpose of holding an agricultural exhibition, a single woollen mill somewhere in this county, to which he proposed to carry his small Merino fleeces for the purpose of having them manufactured into cloth. But the business of manufacturing, in this county and in this whole State, was in the hands of private individuals. You can go to-day into the secluded spots of this town and others, and find the old implements with which your mothers manufactured the cloth which, colored with splendid and beautiful hues, adorned your fathers on their way to church or town meeting. That is the way manufacturing was carried on here. It was agriculture that lay at the foundation of the whole business; and so profitable and prosperous was it, that in my own county, I am happy to say, the record gives us one hundred seventeen and one-half bushels of corn to the acre —almost vieing with Berkshire County; eight hundred bushels of Swedes; one thousand bushels of mangolds; three and one-half tons of hay; six or seven hundred bushels of triumphant potatoes. What times for farming those were! And so successful was the farming industry of this Commonwealth and the rest of the States of this Union, that when our country emerged from the Revolutionary war, with a great war debt resting upon it, it was out of large agriculture, scattered up and down the Atlantic coast, and small commerce, bringing its wealth into a few little ports in Essex County, almost alone—I say it was out of large agriculture and small commerce that the patriotic fathers drew that wealth with which they paid a large proportion of the Revolutionary war debt before a quarter of a century had passed away.

So I say it is not because the farming of this State has not been successful that we are establishing an agricultural college here; it is not because the farmers of this State are ignorant of certain principles of agriculture upon which, heretofore, they have been successful, that this college has been established; but it is because, under the trials of modern agriculture, the best education is necessary in order to enable the farmers of the State to carry on their business profitably and successfully. It

is the application of definite rules to the business of agriculture that we are striving for.

Now, my friends, I have been more struck since I came to this meeting than I ever was before with the victory which positive science has achieved over the knowledge which we farmers —for I say I have brought it myself—bring to our debates. There have been but two things that have been unquestioned here. One was, the demonstration of the physical economy of the cow, as the source from which your dairy products were drawn,—the natural history of the cow, demonstrated here before you upon scientific principles, under scientific rules; and the other was, the lecture to which we listened last night upon the breeding of fishes, and the introduction, once more, of fishes into our streams. No man here could deny the statements of those two gentlemen, who planted themselves upon definite science. Nobody undertook to deny those diagrams, that I have heard of. Nobody undertook to debate the fact stated by Prof. Agassiz, that when the young trout came out of his egg, he had a bag hanging on his lower side which he must be rid of before he could come to perfection—a bag of sins, perhaps, like that which Christian cast away before he reached the top of the Celestial Mountains. Nobody questioned that; there was no doubt raised about it. Nobody doubted for a moment that what we were told here of the great lacteal organization of the cow was true; it was demonstrated to us. But the instant a speculating, inexperienced but perhaps thoughtful farmer got up here and undertook to say that you must not feed a cow upon corn-meal, what an uproar it made! And when he told you that it would not do to feed green corn, sown in rows, to your cows, for the purpose of raising milk, there was another row. And what an excitement it created when my distinguished friend said you must not let your orchards go to grass land! These questions that relate to practical agriculture are the only questions that we have found open to debate here; but we have been obliged to surrender, in spite of ourselves, to the positive and definite demonstrations and declarations of scientific men alone.

Now, gentlemen, the business of agricultural education is to stop this debate, if we can; to give us some definite rules by which we can carry on our business. The great questions of

cultivation are just as much open to-day as they were when the first cattle-show was held in this village; there are just the same doubts raised as to the best way of selecting animals and the best mode of feeding them. These questions are all open, and if you examine the agricultural literature of this Commonwealth, you will find that precisely the same questions that were debated here half a century ago are debated now, and that we, who think ourselves so much wiser than our fathers, have come no nearer to any definite conclusion than they did. I believe that this should not be so. I think there are definite rules which can be laid down for the guidance of the farmer, just as much as there are definite rules that can be laid down for the guidance of scientific men in the studio or in the laboratory. I have not the least doubt of it, and it is for that reason that we who believe in agricultural education, and in education of all sorts, as applied to the practical forces of life, are continually urging the support of the Agricultural College on the people of this Commonwealth.

I think we ought to remember that upon nothing but the best intelligence and the best education can we arrive at any satisfactory conclusions. As free and independent citizens of the Commonwealth of Massachusetts, we may enjoy the privilege of groping in the dark as much as we please, but we do not arrive at any definite ends. We may gather together a mass of figures of one sort and another, but if they tell no definite story, we are none the wiser for it. It is because we have our own interests in our own hands, and can confine ourselves to them, that we are compelled to exercise the best knowledge we can possibly obtain in all the great business of life. So the farmer here needs education. He needs it for two reasons. In the first place, that he may maintain his social and civil position with dignity and propriety; and in the next place, in order that he may carry on the business of farming successfully and prosperously.

Now, what is the social position of the farmer in Massachusetts? What is the difference between the farmer here and in Europe? The difference is, that the farmer here is the owner of his own soil, be his acres many or few, and it is for him in his own wisdom to settle how that little spot of land known as his farm shall be cultivated, for his benefit and the benefit of his

family. There have been certain curious and remarkable questions raised on the other side of the water within the last two or three months, that will illustrate this. Every man who is interested in the great political movements of the world knows that under the leadership of the great English statesman, Mr. Gladstone, the Irish Church has been disestablished, and at last the question comes up, how the lands shall be disposed of, that the Irish farmers may carry them on at a profit. As one of the consequences of the debates and liberal legislation of that kingdom, attempts have been made to ascertain what were the relations between landlord and tenant here.

In an interview which I had with Mr. Murray, who came here as a friend of John Bright, last autumn, this interesting question arose; and all the answer I could give him was that such a relation, as understood in his own country, did not exist here. Rented farms are rarely seen. The lands are cultivated by the owners generally, the harvests are reaped by them. They are the "laboring class" upon the land. Other than such as these we have no "laboring class," that portion of society in which Mr. Bright is especially interested. Labor is the business of all men. Every man works, more or less. The farmer works, the clergymen works, the judge works, or thinks he does, and we all work. In the shop, or in the mill, or on the land, or in the pulpit, we are all engaged in doing some business here. If a man cannot get a living in one way, he will try to do it in another. That is the way we labor here. "Well," said he, "how does the laborer live?" "Go with me to the window and select the best house you can see; in such they live." "What is the internal condition of their houses?" "Just as good inside as outside." "They are represented here by intelligent, active, vigorous men, appreciating entirely their condition in society; and when they return home, three-quarters of these men will settle down into the exact condition which you call the condition of the working class; that is, they will go to work either with their hands or brains to earn their daily bread. They are the mechanics, the manufacturers and the farmers of Massachusetts, and in this way they live."

Not long ago, an English gentleman brought me a list of questions relating to the rotation of crops, the general management of the farm, the amount of barley and wheat and corn

raised to the acre; and he too desired to know the relation between the landlord and the tenant. To him I presented the same view, with the assurance that the success of American agriculture depended on the absolute ownership of the land, by him who expected to obtain a subsistence from his acres. No where in the world is the value of this system of small ownership understood as it is here.

That is the civil and social position to which I allude when I say that every man is responsible for the mode in which he conducts his agriculture. So with the whole business of farming. The laboring man upon a farm is a prosperous man. You all know it. A man who can get $25 or $30 a month, for eight months in the year, and his living, is getting as good a share of the whole profits of the farm, and of the income of the farm, as the owner himself. As a general thing, those persons who labor upon the land are the prosperous laborers.

Now mark the distinction between the class of people laboring here, among an intelligent community of farmers, and those who labor in Europe in the same position. I have just read with the greatest interest a report of Mr. Howard, who was sent to France by the Farmer's Club of London, a portion of whom belong to the Royal Agricultural Society, for the purpose of examining the crops, and ascertaining the modes of labor there. He reports upon the raising of beet-root sugar and other crops, and that the laborer there was getting from four and a half to ten pence,—that is, from nine to twenty cents,—a day for his labor.

After setting forth the impossibility of labor subsisting on such wages, and contrasting the amount of service performed in France and in his own country, per day, on all public and private works, he declares that the system of small farms existing in France is inapplicable to the state of society there. He urges the management of large estates by subordinate labor, and the control of land by capitalists, as the only system that can be profitable in a country like that.

This is the difference between society, labor and capital here and in Europe; and it is because of the social position and condition here both of the farmers themselves and their labor, that the responsibility rests so heavily upon us to see to it that our

farms are intelligently managed, and more than all that, that our labor is well paid.

You may say that all this can be done, and that agricultural education can be obtained without a college; that a man does not need to be able to decline a Latin noun and conjugate a Greek verb, scan a line in Homer, and break his neck over another one in Horace, in order to be a good farmer. I agree that that is not necessary; but it is necessary that a man in this world, in order to maintain his position as a farmer, a mechanic, a merchant, or a lawyer, should know as much as he can know. It is astonishing, my friends, how we respect an intelligent man who can give good reasons for the mode in which he transacts his business. How we all admire to listen to the great results of mental labor and investigation. How we sat in silent admiration last evening, and heard the greatest naturalist of the world discuss in his inimitable style the simplest questions, merely because we bow to his knowledge and believe in it. Hence it is that the education of a college elevates a man in his own power for good, and more than all that, elevates him in the estimation of his neighbors, if he employs his knowledge in a useful pursuit. With us, moreover, the whole business of farming is a special business. It is not a wholesale, ill-arranged affair; it is the application of the highest intelligence to the nicest cultivation of the farm. The time when the wholesale business of farming in Massachusetts was as profitable as I told you it once was, has long since passed away. I doubt if there is a man in Massachusetts, the owner of large lands, who could possibly adopt the agricultural system of his fathers and succeed as a farmer. Then, it was a little hay to sell; it was a few cattle fattened upon these luxuriant hill-sides; it was a few bushels of corn; it was a little grain; it was a few potatoes; it was simple habits of home; it was low taxation; it was cheap labor. That is a true picture of the old times, is it not? But now the time has come when every man who proposes to get an income from the land must apply himself to some special business, and apply to that business the best rules that can possibly be taught him by the most skilful practical farmers, and the best science you can obtain from the Agricultural College. It is the cultivation, for instance, of great root crops,—onions, mangolds, turnips,—economically, successfully, profitably, that makes the farmers of

Danvers and Marblehead prosperous and independent. That is special agriculture. It is the cranberry crop of Cape Cod, where the intelligent and careful cultivator has turned the most useless bogs into profitable acres. It is tobacco in the Connecticut River Valley. What an astonishing product!—equal as the Professor of Agriculture told us this morning, to almost all the rest of the agriculture of the State; superior to the dairy, superior to gardening, and equal to almost all the other branches of agricultural industry in this Commonwealth. That is a specialty. It is breeding and feeding the choicest herds of cattle. It is the careful breeding of Shorthorns, Devons, Jerseys and Ayrshires. It is careful attention to the most economical mode of feeding animals that makes our farmers rich and prosperous. Go where you will, it is the adoption of some specialty which has made the farmers of Massachusetts able to sustain themselves.

I have in my mind—and it is always before me when I am speaking of the agricultural prosperity of Massachusetts—that instance of a farmer in the town of Arlington, (I know some of you have heard it before, but it is worth repeating over and over again,) who, in 1835, purchased thirty-six acres of land for $6,000, mortgaged the farm for the payment of one-half of it, and was thought by his neighbors to be a madman. From that time to this he has gone on devoting himself to the special crops of that section, until he is worth to-day, with his accumulations and his interest, $250,000, which he has wrung out of that soil. Not quite as good as a Berkshire woollen mill, but it will come up pretty nearly alongside of it. Every month in the year he has a green crop—out of doors in summer, under glass in winter—supplying the markets of New York and Boston with the choicest vegetables.

Now, gentlemen, the business that has been done there by that farmer can be done elsewhere, and has been done elsewhere, perhaps to a less degree. It is by devotion to these special crops, to which the markets are adapted,—to small fruits, to market gardening, to tobacco, to onions, to cranberries, to the breeding and feeding of the cattle best adapted to the production of beef in beef regions, and of milk in dairy regions,—that the farmers of Massachusetts are able to get their living.

Now, my friends, it is to put this business of farming beyond debate that we have faith in the Agricultural College. I have not the slightest doubt that definite rules for agriculture may be laid down there, and will be, so that we shall all understand them, appreciate them, accept them, and be governed by them, as our guides in this great business.

I know perfectly well that you will turn about and say, some of you, that the knowledge you will get there is no better than the knowledge you have got heretofore from your practice on the farm, and from the records that have gone into your Transactions. But suppose, my friends, that this college had been planted there fifty years ago; suppose that the agricultural literature which had been printed in this Commonwealth, instead of having been disseminated broadcast by the societies themselves, or printed in the crude forms in which it comes from us,—I say from us, because it is a matter of experiment and investigation with us still,—had been sent to an agricultural board of scientific investigators, who would have analyzed it, and tabulated it, and experimented upon it, and drawn rules from it, and then sent it out; suppose, I say, that this had been done, should we not have been better off to-day? Would you not be a little wiser in regard to the best methods of culture? Do you not think we should have known a little more than we now pretend to know about the best mode of feeding cattle and the best modes of breeding them? And do you not think that somehow or other we should have been able to come together here, and instead of disputing, have added to the amount of each other's knowledge? It does seem to me so. And when I learned that an agricultural college was to be established here, my first thought was, "Let the agricultural literature of this Commonwealth flow into that college first, and then flow out again for the enriching of the people." I tell you, my friends, that that institution should be the centre of the agricultural information of this State; and if a man has made a good experiment in cultivation, or in the breeding of cattle, if he has learned a new law with regard to fruit-trees, if he has by observation learned a new fact with regard to insects destructive to vegetation, let him send it there for analysis and investigation, and before he knows it, some intelligent professor will have drawn a law from it which will guide him in his future business

of farming. It seems to me that is one of the most practical and most useful points in which that college can serve the cause of agriculture in Massachusetts.

Now, for this purpose, we have bound, (I say " we," because, little as I have had to do in an official way with this college, I am grateful that I have had the power given me to do it some good,) we have bound every farmer in this Commonwealth, directly or indirectly, with that institution. The Board of Agriculture, which represents the agricultural industry of this Commonwealth, is constituted by law a board of overseers there. Every farmer who is a member of this Board represents a certain section of farmers, and knows, or ought to know, what the local interests which he represents are. He is intimately acquainted with the farmers who send him there, and so it is that that college to-day is brought into immediate and intimate relations with all the practical farmers in this Commonwealth. So, if you have raised a good crop, let them know it there. If you can give them any information, carry it there; and be sure that, in the long run, when the information which you have carried there has been tested, it will come back to you as a rich legacy from that institution which you are bound and proud to support. It is in that way that the farmers of the Commonwealth are bound to the college; and I assure you, my friends, that there is no man engaged in the cultivation of fruit, no man engaged in the production of grass or corn or grain or cattle, in this State, who, if he will only believe in the Agricultural College, may not draw information from it which will enable him to carry on these branches of business to greater profit than he has heretofore done.

But you may tell me that science does not lay down any law; that a man can demonstrate the anatomy of the cow, or tell you how a fish is hatched, which fin grows first, and what his tail looks like; but that does you no good. But it does. In the first place, it liberalizes your mind—one of the best things that can be done for you. There is nothing in the world like keeping a man's mind open, receptive; the instant it closes up, there is an end of him. Keep his mind open, free, liberal, ready to investigate, ready to listen, and if he will only believe in careful investigation, it will open a way by which he can overcome all his obstacles and difficulties. It will teach him what lands to

drain and what not to drain; it will teach him how to carry on his war against insects; it will teach him what kind of food is best for his animals; it will teach him how he can prepare his fertilizers, and put them in the most economical way into his soil, and so arrange them that from that soil he can draw the largest crops.

I think, therefore, we ought to listen to the rules laid down by these teachers, and believe in them; we ought, in our own operations, to contribute our share; we ought to encourage the Commonwealth in sustaining this institution; we ought to believe in science, in this great scientific age of the world. And when we are told that no other branch of business in the community asks for education,—that the mechanic runs his shop, the manufacturer runs his mill, the merchant runs his counting-room, all without the aid of science and without education, and therefore the farmer should transact his business without education,—let us remind these gentlemen that every conceivable branch of business in this world has its teachers except the farmer. Why, sir, how many scientific engineers were educated in this Commonwealth before you could dam up the Connecticut River and the Merrimack River, for the establishment of Holyoke and Chicopee and Lawrence and Lowell? Was it ignorance which accomplished that work? No; it was the application of the best rules of science that prepared the way for the manufacturer to build his mill upon those streams—mills involving the nicest principles of the best science and best mechanics of the age. That is what education has done for manufactures. It has taken the business of manufacturing out of our kitchens and garrets, and placed it into palaces. Has it done nothing for mechanics? It has developed all those industries which make mechanics prosperous. Has it done nothing for our taste? Were not your architects and landscape-gardeners educated? Why, every book-keeper, every clerk, every lawyer and clergyman and physician, every manufacturer, has an opportunity to avail himself of knowledge which is specially adapted to his purpose. Why, then, should not the farmer, who is engaged in a vastly more intricate and difficult business, have his education also? Is there any reason? You all know one man of the last century, who was a distinguished lawyer, a great statesman, a great writer, a great orator; he left an im-

mortal name in history, and made his mark in the British Parliament as one of the great lights of that kingdom. He knew what it was to succeed on every field except his farm at Beaconsfield; and after he had exhausted his wisdom in literature, in scientific investigation and in statesmanship, Edmund Burke went to the farm to learn that to be a good farmer required, as he said, more common-sense, observation, judgment and wisdom than all the other work which he had endeavored to accomplish in life.

Will you tell me, now, that knowledge is unnecessary to the farmer? He should know all he possibly can know; and the first and best knowledge he can have is that which will protect him against false theories and false assumptions of any kind.

I am sure our boys can be well taught in this college. If they apply their knowledge to the land, so much the better; if to other pursuits, even then their education will not have been in vain. A knowledge of land-management is useful to all men—to all who would be practically useful in their day and generation—to all who would enjoy the refinements of rural life. I would send a boy to the Agricultural College, even if he was destined to a professional life. Our young men enter upon their classical career often too early in life, before they have acquired a taste or physical strength for their work. No man, who has not experienced it, can estimate the exhaustion of an academic career, or understand fully the physical trials of young men, who, striving for high position in a college, are bleached out in those cloisters, where the ambitious boys trim their midnight lamps. So I say I would give a boy practical sense, good muscle and strength, if nothing more, at the Agricultural College, if I intended afterwards to send him to a classical college for the purpose of giving him a professional education.

Do not, then, despair; and if some of these young men do come out ministers, lawyers, engineers or surveyors, it will harm no man and no State. But they will not all come out in that way. There is an astonishing attraction about the soil. We all have, or should have, our rural tastes; and when a man has once acquired a taste for the land, it never dies, until he passes away from earth. A boy goes from this county into the city, and begins at once to make his fortune, guided by the good

principles that were taught him by his mother, and the skill, ingenuity and tact which he inherited, and the first thing he desires is a little farm, and the animals that go with it, to remind him of the valley in which he was born, and bring him back once more to the farm of his fathers. There is no taste which adheres to us so persistently as love of the land, and there is none in which there is more happiness or more enjoyment. Will it injure our boys, therefore, if they get this taste for the land, and if, in after life, they should return to their homes and embellish those lands their fathers have left them, deserted perhaps too soon? If you could find, moreover, an intelligent foreman—one who had brought from the Agricultural College the means of carrying on your lands in a way that would be profitable to you—it would fill for you a place not easily filled. If you had a bright, substantial, broad-shouldered boy, that you loved and desired to keep at home—one who, you believe, would make a good farmer and good citizen, perhaps a good selectman or town clerk, or, possibly, a senator in after life—if you had such a boy as that, would you object to having him educated in such a school, more especially if the love of the land which he might acquire there should keep him on his paternal acres? I do not believe you would. Send your boys to the Agricultural College, then, if you can spare them a year or more in their early education. I tell you it will not destroy the virtue, the industry or the good order of the Commonwealth, to educate thus our boys in the practical service of life, whatever may be the path which they are destined to tread.

I have spoken about the education of the boys, and now I have a word to say about the education of the girls—a branch of the Agricultural College which has not yet been discussed. I believe, my friends, and so do you, in female education. I believe in woman having just as good an education for the practical affairs of life as man has. There is no reason why she should not have it—not the slightest. I do not believe it will disappoint a man, if, when he is attending the social circles that gather together in the villages and towns, and is looking about to find a partner to take him by the hand and go along with him through life, he should find a comely woman, who knew how to discuss something besides ribbons and satins and the last gossip of the village; who had a substantial education, and

knew how to talk with him about his own affairs, the policy of this Commonwealth and country, of which we all are proud. I do not believe a man ever made anything by insisting upon it that his wife should not know as much as he does; and I am sure there is no man in this hall who will say that *his* wife does not know as much as he does. Whatever you may say of others, you will not say that your own wife or daughter is less intelligent than yourself. So I say you all believe in female education. Give, then, to the women of this Commonwealth that kind of practical education which will give them a fair chance in life. You educate your boys for every conceivable service; you educate your girls for no special object. You can name no trade or branch of business for which you educate them. They sometimes educate themselves in various business pursuits, but not through the aid of any system provided for them. They marry, and try to keep house, when, too often, they know nothing of housekeeping. Ask one of them to manage your dairy, a healthful and useful employment, and she will stare at you as if you had asked her to fight a battle or storm a battery.

We want female education in this Commonwealth; and I appeal to the trustees of the Agricultural College not to allow the Cornell University to outstrip this old Commonwealth, that you heard so eulogized this morning. Prof. Chadbourne told us that Massachusetts was ahead in everything. The Cornell University is getting ahead of your Board, sir. There is no reason why it should be so. Let the Agricultural College have a department for the young women of this Commonwealth who desire to make horticulturists of themselves; who desire to learn how to furnish their houses tastefully when they have them, how to take care of our green-houses, and how to perform profitably and well all those details which the hand of woman can always do so much better than the hand of man. There are branches of education, in which the females of Massachusetts can be educated in that college, which will be of service not only to themselves, but to every one who takes an interest in that education which is to elevate all the people of the State up to a proper standard.

Mr. President, I have made a long argument in behalf of the Agricultural College; but I have, in doing it, endeavored simply to discharge a duty which the president of that college

imposed upon me, and which he himself could have discharged so much better than I have done it. I have simply endeavored to speak for that college, which so many of us believe in, and which is the child of this Commonwealth; and I trust that in after years there will be classes of young men sent out from those halls to the hills of Berkshire, who can hold an agricultural meeting here, in this town, from which only exact knowledge and the best science will flow, for the developing and beautifying of a prosperous agriculture.

Dr. DURFEE. I want to make a single remark in regard to one department of the Agricultural College, and that is the botanic. I think that all I have ever done for the Massachusetts Agricultural College has been repaid a thousand fold. At the close of the term last year, while I was visiting Amherst, there was an examination of the herbariums of the students, that were brought into the president's office, and one student presented four hundred varieties of the plants of Massachusetts, all attached to his herbarium, and all in perfect order. Now I say, Mr. President, that this one fact coming to my knowledge, was abundant compensation to me for all that I have ever done for the college.

Col. WILDER. I believe all will agree with me, that we have enjoyed a profitable season while we have been assembled in this hall; that the sessions have been most useful and interesting, and that for the major part of the success of this meeting we are indebted to the Berkshire Agricultural Society and the good citizens of Pittsfield. I therefore desire to present this Resolution:—

Resolved, That the thanks of the Massachusetts Board of Agriculture are due and are hereby tendered to the Berkshire Agricultural Society and to the good people of Pittsfield for the ample and excellent accommodations provided for the sessions of the Board, and for the courtesy and attention extended to its members.

Carried unanimously.

Col. WILDER. I desire also to say, in reply to the remark of the Hon. Mr. Colt, that he hoped we should again visit this

region, at some more genial season, that whatever may be the grandeur and beauty of the Berkshire hills, whatever may be the fertility and verdure of her vales, whatever may be the excellence and purity of her stock, whatever her agricultural products may have been, we have had the evidence that her best crop is her worthy men, who have honored these meetings with their presence. It has given me great pleasure to see present on this occasion our venerable friend, Dr. Todd, whose peculiar province is the care and cultivation of the soul, but who has manifested during our meetings in this hall so lively an interest in the cultivation of the soil, that I desire to ask him if he will favor us with an address.

Rev. Dr. TODD. We Berkshire people live so far one side of Massachusetts, that we do not often have the honor of a visit from the people of the eastern or middle part of the State. If the good old mother builds a hospital, or an insane asylum, or a college, or any State institution, she stops before she gets here; and when the folks come up from New York to see our hills and breathe this air, and find that this is Massachusetts, they sometimes look around and wonder where the *institutions* of Massachusetts are! The time may come when our good mother will feel that it may be best to plant something here, and when it does, we promise to take good care of the child that she sends here.

I claim to be a farmer myself, because, by the kindness of my friend, Mr. Plunkett, I once bought a farm for $1,550, and it will give you an exalted idea of the powers of that man to know that he actually got the pay for it! I ran that farm until I found my salary would not support it, making all manner of experiments, to my own satisfaction; and when I sold the farm I took ample revenge, for I have been eating it up ever since.

I desire, in behalf of the Pittsfield people and the Berkshire people, to thank the Board for coming here. I am glad that they have come and have had a good meeting, and are satisfied. If they are satisfied with Pittsfield, I have only to say that Pittsfield is perfectly delighted with the Board. We shall remember this meeting, and hope the time is not far distant when it will be repeated.

Dr. LORING. The endeavors that have been made at this meeting to report the proceedings in the public press have been

creditable to the press and extremely gratifying to the Board. I therefore offer this Resolution :—

Resolved, That the thanks of the Board of Agriculture of Massachusetts are hereby tendered to the "New York Tribune," "Springfield Republican," "Massachusetts Ploughman," "Homestead," "Hearth and Home," and the local papers for their reports of the proceedings of this session of the Board.

The Resolution was adopted, and the Board adjourned *sine die.*

ANNUAL MEETING.

The Board met at the office of the Secretary, in Boston, on Thursday, January 27th, 1870.

Present: Messrs. Baker, Bassett, Birnie, Blair, Boise, Bradford, Brown, Clement, Ellsworth, Fearing, Hubbard, Jas. F. C. Hyde, Johnson, Knowlton, Loring, Moore, Morton, Porter, Saltonstall, Slade, Stone, Thatcher, Thompson, Ward and Wilder.

Col. Wilder was requested to preside, and accordingly took the chair.

A committee on the order of business was appointed, consisting of Messrs. Saltonstall, Birnie and Thatcher.

While the committee was out, the Secretary laid before the Board a communication from Mr. Hebron Vincent of Edgartown, in relation to the organization of Farmers' Institutes, as follows: —

Edgartown, Mass., January 20, 1870.

My Dear Sir: — I intended sooner to have given you a sketch of the plan which has suggested itself to my mind, and upon which we exchanged views when last I saw you at your office. The subject of Agricultural Institutes, to be held in the several agricultural districts of the State, is one which has commended itself to my own mind for the last two or three years. I have conversed freely upon the subject with many of our friends, and find, so far, a very general concurrence with my views.

My plan, in substance, is, to hold meetings, at proper intervals, in some convenient part of each section of the State comprising the limits of an agricultural society, somewhat after the style of the

State Teachers' Institutes. As there are about thirty societies, perhaps ten a year would be sufficient, which would give to each society an institute once in three years. Of course I would not suggest all the details usual at a Teachers' Institute, nor anything like the number of lecturers. I would say, let the Secretary of the State Board plan the arrangements for such meeting, and have the charge; or, in case he could not attend, appoint a substitute. Perhaps one or two lecturers besides the Secretary, or other person having the charge, would be all-sufficient. Have all the farmers of the district who can, come together, and let the sessions be for two, three, or four days, as should be judged best. Let the lectures be on practical topics connected with agriculture and horticulture, but mainly the former; and following each lecture, let there be the most perfect freedom given to the audience to propose questions to the speaker, and to enter into discussion on the matters presented. To give still greater variety and interest, a part of the sessions might be occupied in discussions upon subjects previously assigned, speakers from among the citizens having been appointed, and others, with the professors, freely participating. Covering the time in these various ways, spiced, occasionally, with music, and graced by the presence of the ladies, if they please to attend, it is believed the farmers would feel a great interest in such gatherings, and could but be greatly profited. All the teaching should be plain as well as practical, the more so the better.

Our agricultural college is a noble institution, and should receive every needful support and encouragement. It is doing, and will do a good work. But at present, at least, the number of educated farmers it sends out must be small in comparison with the great masses of the people who need light, and it probably can never supply, fully, that service to the masses which such gatherings as I propose would render. Bringing instruction down to their door-stones, and so intimately connecting it with their interests, they would feel that the Institute was their own institution, and would prize it all the more for that fact.

The only objection of any weight to the plan may be the expense. It may be urged that we want to appropriate all we can to the college. Very well. But the expense for this would be trifling compared with what we expend on the college. While fifty or a hundred thousand is asked for at a time for the latter, some two, three, or four thousand a year is all that under any circumstances could be needed annually for the former; while for the present, to say the least, the institutes held as I have suggested, would be far more

wide-spread in diffusing knowledge, and sowing the seeds of truth on agricultural subjects.

Trusting that the State Board of Agriculture will favorably consider this subject, and that the legislature will pass an Act which may be recommended by the Board, providing for such a system of diffusing knowledge on this important subject,

I remain yours, very respectfully,

HEBRON VINCENT.

This communication was laid on the table, when the Committee on the Order of Business submitted the following

REPORT.

1st. Reports of Delegates.

2d. Reports of Committees.

3d. All matters relating to the Agricultural College.

4th. Miscellaneous business.

It is not intended to render it out of order for a delegate to offer any matter of reference at any stage of the debates.

L. SALTONSTALL, *Chairman.*

The reports of delegates to the various agricultural societies were then submitted, as follows:—

Col. Wilder reported upon the Essex, Mr. Boise upon the Middlesex North, Mr. Clement upon the Worcester, Mr. Porter upon the Worcester West, Mr. Birnie upon the Worcester North, Mr. Stone upon the Worcester North-West, Mr. Morton upon the Worcester South, Mr. Ellsworth upon the Worcester South-East, Mr. Brown upon the Hampden, Mr. Ward upon the Hampden East, Mr. Bassett upon the Union, Mr. Slade upon the Housatonic, and Mr. Knowlton upon the Bristol Central.

These reports, after discussion, were laid over under the rule.

The Committee appointed at the Pittsfield meeting, upon Roads and Road Making, consisting of Messrs. Jas. F. C. Hyde, N. S. Hubbard and A. P. Slade, having asked for instructions, it was, after some discussion,—

Voted, To refer the whole matter to the committee to consider and report the proper course to be adopted in regard to the essays which had been submitted for their inspection.

Adjourned.

SECOND DAY.

The Board met at 10 o'clock, A. M., Hon. MARSHALL P. WILDER in the Chair.

The reports of delegates being in order, Mr. Johnson submitted a report upon the fair of the Hingham Society, Mr. Blair upon the Marshfield, Mr. Hubbard upon the Martha's Vineyard, Mr. Thompson upon the Highland, Mr. Johnson upon the Norfolk, and Mr. Plunkett upon the Hampshire, Franklin and Hampden.

These reports were laid over under the rule, to take their second reading in order.

Mr. JOHN B. MOORE, chairman, then submitted the following Essay upon the

PREPARATION OF THE SOIL AND PLANTING OF THE SEED.

Perhaps it is hardly necessary to say, that it is of the utmost importance, in all attempts to produce crops, that we proceed at the proper time, carefully and thoroughly, to make such a preparation of the soil as shall insure, as nearly as possible, as full and perfect a crop of whatever grains, roots, vegetables or fruits we desire to produce.

I do not apprehend any dissent from this proposition, for the advancement in agricultural knowledge, the more careful cultivation of the soil, the improved tools specially designed to do better and more thorough work, the improved breeds of domestic animals, and better varieties of all cultivated grains, fruits and vegetables, prove that the intelligent cultivators of the soil have accepted this proposition as true.

What we may have to say about the preparation of soils, perhaps all will not accept as the best method. For ourselves, we can only say that we have no theories that we desire to push, and if we advance any wrong ideas, you will of course discuss them and set us right; for, after all, it is by the comparison, discussion and trial of different methods that we arrive at correct conclusions.

Ploughing is the first thing to be done in preparing the soil for the seed. This is a very important operation, and should always be done with a good and suitable plough. The rule should be to take a furrow narrow enough to thoroughly move and break up the entire soil as deep as the plough runs; and

nothing short of this should be permitted or can be called good ploughing.

Any observing person must have noticed the difference in the pulverization of the soil produced by ploughs of the various patterns now in use, some of them, more particularly in ploughing sod ground, turning over and hardly cracking the inverted furrow, leaving the ground hard and compact; others, turning the sod just as well, and, in addition, breaking and loosening the whole mass, and leaving it in a light and friable condition. Now the last is much the best condition to leave it in, and will save a great deal of labor in harrowing, hoeing and after-cultivation of the crops. And therefore we say, that there is nothing saved, but much lost, by slighting this the first operation in the cultivation of the land. Bad ploughing cannot, by any after-preparation, such as harrowing or hoeing, be entirely remedied; for if the land is not well ploughed, the entire soil is not brought to that light and friable condition so essential to perfect vegetation. There are left in the soil hard and unloosened places, partially, if not wholly, impenetrable to the fine rootlets of plants; and therefore the area of ground which should be occupied by the roots of the plants to be grown is reduced to nearly the extent of the unstirred soil. And then by using a plough that does not crack, break or crumble into little particles the whole soil, the same result will be obtained to some extent. That is, the hard lumps, covered so deep in the ground as to be out of reach of the harrow, are partially or entirely useless to the future crop; and the cultivator that allows such imperfect work to be done on his land, suffers from it not only in the labor of after-cultivation but in the crops also. And here the old adage, "that whatever is worth doing, is worth doing well," applies as strongly as in any other farm operation.

As to the time of ploughing, as a rule, no land should be ploughed when very wet. It is injurious to all soils, but more particularly to a clay or a very wet soil, which are left by such a ploughing in a hard and lumpy condition, compacted in some cases almost like mortar, and in an extremely unfavorable condition for vegetation. After ploughing, the land should be harrowed for the purpose of breaking lumps, working the soil to a fine tilth, and levelling any little inequalities of the surface. On

old ground, there is often a gain in the crop by ploughing and harrowing more than once before seeding, particularly where the land is to be sowed to roots, as the second ploughing not only produces a more perfect pulverization but destroys a crop of weeds just germinating.

For an inverted sod, one of your Committee has found "Shares' Harrow" to be altogether the best and most perfect instrument in use. It not only pulverizes the soil thoroughly and deeply, but it does it without pulling up the sod. It is also claimed that it puts in seed at a uniform depth, covering the whole, and leaving none on the surface of the ground.

These are the usual mechanical operations practised in preparing land to be planted with the various crops. But this should be only a part of the preparation; for, to produce good crops, the plants must be supplied with nutriment adapted to their sustenance, and in such quantities and in such a condition as to be readily taken up and assimilated by the plant, to insure a full crop. Now it is a well-settled fact that a perfect or a fat animal cannot be produced upon poor, miserable keeping, that two cans of milk a day cannot be got from a cow fed on coarse sedge alone; but it would be just as reasonable to expect such a result as it would be to produce one hundred bushels of corn, fifty bushels of wheat or five hundred bushels of potatoes on an acre upon our worn soils, without supplying sufficient manure adapted to their vigorous growth.

Therefore, while we would urge the great importance of ploughing, harrowing and stirring the ground thoroughly, that alone is not sufficient to produce crops on our soils. There must be a good supply of manure, and it must be applied in abundance, if we desire large crops. Barnyard manure is and must continue to be the principal source of fertilization of the land, combining as it does most of the ingredients required for the growth of all plants. It not only furnishes food for plants, but, when mixed with the soil, it acts as a divisor, and in the process of decomposition generates gases which permeate and loosen the soil, making it light and friable; and it also dissolves or liberates mineral matters already in the soil, fitting them for plant-food. Still there are certain elements required by the various kinds of plants cultivated that are not furnished in sufficient quantities for their full and perfect devel-

opment without applying that manure in very large quantities. Now, instead of that, would it not be better to apply a good but more moderate quantity of such manure, and also if it does not contain in itself everything necessary for the particular crop to be grown, than to apply, in addition, a sufficient quantity of such particular element or food to supply all such wants?

It is perfectly clear to our minds, not so much by an analysis of the plants themselves by chemists,—for no chemist can tell the exact wants of plants by an analysis of the plant itself, or how much of any particular manure to apply for any crop by an analysis of the soil,—as by well authenticated experiments and by our own experience, that certain varieties of plants do require, as they are said, a certain food. Wheat and corn require nitrogen and potash; turnips and cabbages, phosphates; potatoes, potash in large quantities. Now all these varieties of plants require all the elements named, but each of them requires the particular one assigned to it largely in excess of the others. Therefore a heavy dressing of barnyard manure—say one hundred loads to the acre—applied on good land for corn, containing as it does a very large amount of nitrogen and potash, would produce a large and luxuriant crop of corn. The same amount of manure applied for turnips or potatoes, although the soil might contain everything needed for them, yet perhaps they would be so overstimulated by the large amount of nitrogen as to force them to tops, and thus lessen the crop.

As some may doubt this proposition, perhaps we can illustrate it in this way: take a field upon which the manure has laid in a pile the previous winter; of course under the pile it is exceedingly rich in ammonia and other matters which have washed and soaked down from the heap above. If planted with corn it will be the largest and most productive spot in the field, from the fact of the great supply of this desirable food furnished it; but what is the result if planted with turnips or potatoes: why great tops, poor turnips and small potatoes, from the great excess of nitrogenous substances, which are too stimulating.

Therefore, in preparing soils, while we would apply barnyard manure plentifully if we had it, we would also add to the soil a quantity of such other particular substances as in our judgment the crop might require; this, with a thorough pulverization of the soil, and an intimate mixture of the manure suit-

able for the expected crop, ought, with a favorable season, to produce good results.

We have not said anything about draining, an important operation in preparing soils where too wet, as we understood the subject to apply to soils otherwise suitable for crops. This thorough preparation of the soil is of the greatest importance to market gardeners, and to the growers of small fruits. Andrew Fuller, in the Small Fruit Culturist, expresses his belief that there is not one acre of strawberries in a thousand, cultivated in this country, that yields one-half that it would if the ground was properly prepared before planting. Your Committee are also well satisfied that, in the preparation of soils, it is beneficial to the crops to dress low or peaty soils composed of vegetable matter to a large extent, either with sand directly, or with sand, or sandy loam in the composts to be applied to such soils, as they are usually deficient in silica, so necessary in the production of grass or grain; and that muck applied to a sandy soil, when it can be procured within a reasonable distance, furnishes such a soil with the vegetable matter that it is usually deficient in. It also acts as an absorbent, retaining the water, and, to some extent, preventing damage from a drought.

Perhaps the better way would be to use muck in the compost heap; there it retains the ammonia, absorbs the gases, and is undoubtedly one of the best of deodorizers; such a compost is particularly adapted to fruit trees and small fruits, and is in fact a good dressing for almost any crop, and by many thought to be equal to manure, load for load, in value. We have also seen excellent results from its application to clayey soils; by mixing with the clay it prevents such a soil from compacting and baking in a dry time, as well as by furnishing plant food. Of course the foregoing remarks about the use of muck are intended to apply to a good article. We are well aware that there are beds of muck, so charged with mineral or other matters as to be entirely unfit for vegetation, or certainly until such noxious substances are neutralized by some proper preparation.

Before planting the seed, the first thing to be done is to procure a suitable variety to be grown, and no reasonable expense should be spared to procure such a variety. Good seed may be known by its weight, size, and plumpness. A poor, shrivelled or imperfect seed may be capable of germination, and in many

instances grow, but will be likely to produce inferior plants and seed, while with the same soil and cultivation the best and most perfect seed will be sure to produce the largest and best crop.

The maxim "that like produces like" is certainly true in regard to cultivated plants, as well as in the breeding of animals, where the varieties of the same species are not exposed to mixture by accidental hybridization.

In planting seeds, certain conditions of the same are necessary, a certain degree of warmth, moisture, and some exposure to the air, according to the wants of the different species of plants, are necessary to produce vegetation. To produce this in its greatest perfection, a seed must be buried in the soil only to a proper depth; small seeds are frequently destroyed by too deep planting; the air, moisture and warmth act on the outer covering, the whole seed swells, and some change takes place within the seed, by which its substance is changed and prepared to nourish the swelling germ. The first shoot which appears from a seed is a small delicate root; this always grows down, while a stalk shoots up towards the surface, and bursts forth from the ground and forms a plant.

These little roots which start first and penetrate downwards, as we have before said, are very delicate and tender; they have gone in search of food for the young embryo plant, and to produce vigorous and healthy plants, must come in contact at once in the soil with proper food for its nourishment. If this food is not there, or in such a condition that the plant cannot feed upon it, the plant will perish; if there in insufficient quantities, it can only produce a half-starved plant; and even if there in abundance with the soil not thoroughly pulverized and still full of hard lumps, the plants cannot arrive to perfection.

This again illustrates the necessity of thorough preparation of the soil previous to planting.

It is undoubtedly better to plant the seed of all the grains, and also the root crops in drills or hills, as it leaves them in a more favorable condition to weed, hoe and cultivate than if sown broadcast; the English generally, and the Americans, to some extent, drill-in their wheat, and also hoe and weed it where they give it the highest cultivation; by this process they save enough seed to pay the extra expense of drilling machines, and also increase their crop; the grain stands better, the air circulates

through it better, every seed is covered perfectly and is about sure to vegetate.

In planting the smaller seeds, as the carrot, parsnip, onion, and the various grass seeds, care should be taken not to cover too deep, as many of them start so feebly as not to have sufficient strength to reach the surface of the ground with heavy covering.

The distance apart that seed should be sown must be governed by the size to which the plant attains when mature.

All plants or trees, to become fully developed and to arrive at their greatest perfection, must have sufficient room to grow. They cannot become what they should be if cramped or confined in any way. This is well illustrated in a thick growth of wood, where there is from necessity a constant contest going on between the neighboring trees for the food in the soil, and a more perfect development of the top in the air, one tree trying to overtop another, so that it may expand and spread its branches and leaves more fully to the light and influences of the atmosphere. If it succeeds in overtopping its weaker neighbor, the latter will grow weaker and weaker, and at last will have to give way to its more powerful competitor, which will thus acquire the room necessary for its full development.

In planting our seeds, therefore, economy of seed and of culture and the perfection of the crop demand that we should plant at the right distances and thin to the proper number of plants to obtain a full crop, not leaving the plants to expend their energies in overpowering and destroying the next plant, instead of fully developing itself; or, as a rule, not to try to grow two plants where there is only room for one.

After all, what is a seed that it should require from the cultivator so careful a preparation of the soil and planting? Why, it is a little embryo plant encased in a shell or husk; an attempt of a plant, or a provision made by which to reproduce itself. Watch its course when planted, and see it develop into a perfect plant, and you will find one of the most interesting and wonderful things in nature. The first thing that takes place is the swelling of the germ and the sprouting of the little root; we may call it the birth of the plant. This little root strikes down into the soil. It seems to have the same instinct that animals have at their birth; the first thing it does is to

seek for food for its support. It sucks its food, composed of mineral, earthy and other matters, from the soil through the little mouths at the extremities of the roots, just as effectively, if not in precisely the same manner, as an animal; and it absorbs the carbon and other necessary food through its leaves from the atmosphere. All its food is taken in a liquid state. It has the power of selecting and depositing in their proper places all the ingredients that make a perfect tree or plant, of perfecting our grains and fruits, and of giving the beautiful colors to our flowers. In fact, it has the power of growing from a little seed—an acorn, for instance—by the processes named, laying on layer upon layer of circles of wood through centuries, and thus forming the noble and sturdy oak, simply by giving it the proper food, ample space and a well-prepared soil.

JOHN B. MOORE.
LEWIS H. BRADFORD.
JOHN T. ELLSWORTH.

This Essay, after an animated discussion, was then laid over under the rule; when Mr. H. S. Porter, Chairman of the Committee upon the subject, submitted the following Essay upon the

BREEDING AND TRAINING OF HORSES.

The breeding of horses is a subject of great importance to the farming interests of our country, and one that almost every person is interested in, either for pleasure or profit. The man, or woman either, who does not like a good horse, would be as hard to find as one who does not like good music. But each one has his own ideas of perfection. One wants a horse that can get himself up in the best possible style; another wants one that can go a mile in 2.25; and still another one wants one that he can hitch to his plough as well as his carriage. As it is impossible for one horse to possess *all* these qualities, we must admit the importance of breeding for some special purpose. In order to produce the best style and action, without particular reference to speed, the parents must be stylish. Where speed is the object, the breeder should select animals whose build is adapted to that purpose. There are among horses, as among cattle, a great many distinct breeds, each having its own peculiar merits. When a man has decided what kind or breed of

horses he wants, either for himself or the market, the next thing is to select a suitable dam. And here I would say that not one in five of such as are called good horses are fit to breed from. Hereditary diseases and even vicious habits, either natural or acquired, are almost certain to be transmitted to the foal. The dam should be of good size, with strong, healthy constitution and a mild disposition, which, by the way, is an important point, and one which can easily be ascertained by those familiar with horses. If the eye is full and intelligent, the forehead broad, the head long and slim, with delicate, high-pointed ears, you have a kind, intelligent and active horse. On the other hand, if he is thick-joled, with eyes small and deeply set, head short and clumsy, with narrow forehead, and heavy, thick ears, you have a dull, stupid horse. Add to this a full, round face, and you have a vicious-tempered animal, as likely to go back as forward, or kick and run away when the opportunity presents itself. The dam should be the largest, and with *her*, ease of movement is considered of greater importance than smoothness of build.

The stallion, from whatever breed he is chosen, should be of pure blood, with great muscular power; not too large, but of perfect symmetry, without blemish or fault. With such parents, the breeder need not fear inferior progeny.

If the mother is not wanted, the best place is in the pasture for the first four or five months after foaling. The colt should then be weaned and given an allowance of milk for a few days or weeks, according to convenience; then good hay, with a quart of oats daily, for the winter, with exercise in the open air in pleasant weather. Grain should not be fed too freely while the colt is growing, but give him plenty of good hay. Never let him get poor; it takes a long time to get back.

When the colt is young, it should be handled and led with a halter, but never harnessed until it is three years old. I know this is not in accordance with the views of many, but my opinion is that many colts are spoiled by being used too young. And here I would say that I strongly disapprove of the practice of trotting colts on our tracks before they come to maturity. I have known many a fine colt spoiled by testing his speed beyond his powers of endurance. Our agricultural societies should

never offer premiums, where speed governs, for horses less than five years old.

When the colt is between three and four years old, let him be harnessed very carefully by some one who knows how to handle a colt—not by any boy that happens to think he knows all about it. Let him stand with the harness on for an hour or two; the next time a little longer; and so on, until he gets perfectly familiar with it. Then, if convenient, hitch him by the side of an old horse to a sled or wagon, and use him very carefully—not too long the first time. Use him so a few times, then hitch him to something alone. Be gentle and patient. If he does not go the first time, be a little indulgent, and wait his motion. Let him understand that you are not going to hurt him. Never manifest any impatience, and on no account use the whip. See that everything is right about the harness; sometimes a very little thing will irritate the colt and make him refuse to go. If you are sure that nothing is wrong, and he still refuses to go, unharness, take a small, stout cord, tie one end to his under jaw, pass the cord over the neck back through the noose at the mouth. Now take the cord in the hands firmly and give it a sudden jerk, first on one side then on the other, for a few minutes. The power is so great that you have perfect control of him. If he is not inclined to follow you, put a surcingle around him, bring the cord back under the surcingle, then pull very gently, bring his head around towards his side. Now tie a cord to one of his fore feet; bring it up through the surcingle over his back; take up his foot, at the same time draw on the cord over his back, so as to keep it off the ground. Then pull the cord attached to his mouth, so as to bring the head around close to his body. If he makes resistance, just hold the cords firmly, and in a few minutes he will yield and be inclined to lie down. Let him do so gently; be careful to have him fall so as not to bring his head under; keep the cords tight, and in two minutes you have the colt under the most perfect control. You can now loosen the cords, handle the colt anywhere, do anything to him, and he is your most obedient servant. Do not keep him down but a short time. When he is up, take the cord from his foot. He has now perfect confidence in your ability to overpower him, and still, if you have been careful, you have not irritated his temper. He will follow you

anywhere. You can harness now, and I venture to say that not one colt in twenty will ever trouble you again. The great secret in breaking and handling horses, is to keep the mastery both over the horse and your own temper.

The intelligence of the horse is wonderful. He remembers every kindness, and, unless his disposition has been soured by bad usage, he will return, by looks and actions, every token of kindness offered him. Always let him know as plainly as possible what you want him to do, then endeavor to make him do as you wish by gentle management. Never resort to the whip until everything else has failed, and then only enough to bring him to submission.

The Arabs, although a vicious and barbarous people, are noted for their kind treatment of their horses. The Arabian horse has been brought to the highest state of intelligence of any breed known. I account for this in the way they are used. The fondness which the horse manifests for his master can only be created by kindness and care on the part of the master. I see no reason why the same treatment would not produce the same results if practised upon our own breeds of horses.

H. S. PORTER.
JOHN B. MOORE.
JOHN JOHNSON, Jr.

This Essay having been discussed and laid over to be taken upon for its second reading, Mr. Slade, of the Visiting Committee of the Agricultural College, submitted the following

REPORT:

In looking over the college farm, the following suggestions occur to your Committee; and they are offered, not in a spirit of fault-finding, but for the benefit of an institution in which we all have a common interest.

We submit then that the general management of the farm, so far as relates to the production of crops and permanent improvements, should not differ in the main from that which an enterprising and successful farmer would give to his own farm. The farm should be properly stocked, and careful and constant attention should be given to the making of manure.

That this is the first step to be taken in the direction of suc-

cessful farming, is an axiom in agriculture that need not be repeated.

We regret to say, that in this important particular a gross negligence was too apparent. Although at the visit of your Committee in December, some twenty two-year-olds had been added to the stock, and all were kept in the barn, yet not a particle of bedding was to be seen, nor was there a single load of loam, muck or sand used in the cellar for an absorbent, nor was the bottom of the cellar cemented. This stock, we were told, was purchased for the purpose of converting hay and grain into manure.

A large portion of the farm is in a somewhat rough state, presenting an uneven surface, and producing an indifferent crop of grass, both as to quality and quantity. Some of the land has been already underdrained, and more of it must be, before its full value can be realized; yet we would not advise an expenditure in this direction, until those sections which do not require draining have been brought into a higher state of cultivation.

The hoed crops which we examined in August were far from looking luxuriant or promising; they did not compare favorably even with similar crops in fields adjoining the college farm. The experiment of raising two good crops on the same ground and at the same time had evidently been on trial, and had proved a failure. Weeds had been allowed to make too rank a growth before they were destroyed, and it was also apparent that they increased about in the ratio as the distance from the paths and travelled roads increased, the margin of the fields being comparatively clean. But in all the crops which we examined, none were observed to be under the rigid rule of clean culture.

The vegetable garden, which was budding with so much promise in the spring, appeared in August to have had a fitful struggle for existence during the summer, and was evidently suffering from the inroads of noxious weeds and insects injurious to vegetation.

Our second visit was made on the 4th of August, and, by invitation, we dined with the students; and it was a noticeable and we might say a significant fact, that the only vegetable found on the bill of fare or on the table was the potato. No fruit of any kind.

Now these facts, taken in connection with the course of lec-

tures which had just been delivered on Market-Gardening and Small Fruit Culture, forced on your Committee the conviction that the theory of agriculture without the practice, was like faith without works.

The boarding-house is furnished with bedding, cooking utensils and furniture by the trustees. A steward takes possession of the house, and furnishes board at a certain rate per week. This, in point of economy, we think is a bad arrangement. Let a competent person take charge of the house, and under the direction of the trustees purchase his stores at wholesale prices, and supply his tables with dairy products from the farm, and with vegetables from a "model vegetable garden," and with beef, pork, mutton and poultry raised and fatted on the farm, and let board be furnished the students at the lowest practicable rates. This would at once create a home market for the products of the farm; and were the students required to become familiar with the best methods by which these supplies are produced, they would acquire lessons in agriculture of more practical value than they could possibly learn in the laboratory or lecture-room.

A cultivated farm in connection with an agricultural college, conveys to the public mind the idea of a model farm, or a farm at least so far as relates to the cultivation of the soil or to husbandry in general, where all is done under the light of science and in the most approved manner, and whose operations in practical agriculture it would be both safe and desirable to follow.

Farmers throughout the Commonwealth are eagerly looking to the college for that light which is to guide them to success in their calling.

Success in agriculture depends to a great extent on an *accurate experimental knowledge.* And we think a series of experiments should be assigned to each class, and the results accurately noted and published for the benefit of the community at large. While we would not have less agricultural instruction in the lecture-room, we would have more exemplified on the farm.

So far as it is possible to do so, let every theory taught in the college be practically illustrated on the farm.

The foregoing suggestions are made with great deference to the board of trustees who have these matters in charge, knowing as we do the many obstacles they have had to contend with, and in the full belief that many extenuating circumstances

might by urged in favor of the somewhat unsettled policy which seems to prevail; yet we feel that much might be done to speedily remedy many of the evils we have enumerated.

A. P. SLADE.
T. D. THATCHER.

THIRD DAY.

The Board met at 10 o'clock, A. M.

Present: Messrs. Baker, Bassett, Blair, Boise, Brown, Clement, Ellsworth, Hubbard, Alexander Hyde, Johnson, Knowlton, Loring, Moore, Morton, Porter, Plunkett, Thatcher, Thompson, Saltonstall, Slade, Stone, Ward and Wilder.

Mr. THATCHER, of Lee, in the chair.

After a discussion in regard to the powers and duties of the Board as Overseers of the Massachusetts Agricultural College, it was

Voted, To take the paper upon Farmers' Institutes from the table and refer it to a committee of three.

This committee was constituted by the appointment of Messrs. Alexander Hyde, Thompson and Saltonstall.

The mode of feeding stock was then considered at considerable length, when the Board adjourned to Monday the 31st.

FOURTH DAY.

The Board met at 11 o'clock, A. M., Hon ALBERT FEARING, of Hingham, in the chair.

It was

Voted, To appoint a committee to report a list of subjects for investigation, and to nominate committees on essays.

Messrs. Clark, Birnie and Stone were constituted the committee.

Voted, To appoint a committee to consider and report upon the time and place of holding the country meeting.

Messrs. Bradford, Johnson and Thompson.

Mr. Thatcher then submitted the following Report upon

CLOVER AS A FERTILIZER.

In considering the subject of clover as a fertilizer, I do not propose to make a lengthy paper upon the subject, but to throw out such thoughts and views as have been suggested by my own experience and in my limited observation among other farmers. I should have let the matter pass without offering any thoughts upon the subject, feeling that I should have been in the *fashion*, to some extent, of the members of this body, were it not a principle of my own, long since settled upon, to endeavor, in whatever position I am placed, to do the best I can to promote the object of our association and employment as agriculturists. If I may draw out or provoke a discussion by what I shall here offer, the object for which these subjects are assigned to their several committees will in some measure have been attained.

Clover will grow on pretty much all soils that have been laid dry by draining or that are naturally dry. It is the basis of good farming on all lands susceptible of alternate husbandry. Its benefits are threefold at least. It breaks, pulverizes and ameliorates the soil by its tap-roots, and it furnishes a cheap food for plants as well as animals. A good clover lay I believe to be worth to a crop as much as five cords of good manure to the acre. To insure a good lay, at least ten or twelve pounds of seed must be sown to the acre, and the ground well prepared for the reception of that seed; and after the seed has been sown I would recommend the rolling of the ground and such other methods of smoothing as different farmers may suggest or adopt as their own. Its value as food for plants depends as much, if not more, upon the quantity of roots as upon the luxuriance of the stems, though the abundance of the latter depends in a great measure upon the number of the former.

To obtain the full value of this plant, we must cultivate it as food for our *crops* as well as for *cattle*, and to use it successfully for our crops, we must use it the first or second year, before it has run out. Where the soil is adapted to the cultivation of clover, there is economy in sowing it with small grains, even though it should be ploughed-in the same or the next season. Ten pounds of seed cost, upon an average, say \$1.50; the labor of sowing is comparatively nothing. Its value to the

next crop cannot be less than quadruple that sum, to say nothing of the feed it may afford or its mechanical amelioration of the soil. My practice has been—and I think many other farmers adopt the same—to mow the clover only one year for cattle-food, and then to turn it under as food for the crops, especially where wheat is to be sown, thus insuring a return to the soil of a mass of rich vegetable matter. Clover is a biennial plant, and of course cannot be depended upon after the second year for hay.

The clover not only imparts fertility when ploughed under, but its roots divide and break the soil while growing, and render it pulverous as they decay. The thicker the plants, the finer and better the herbage ; the more abundant the roots, the greater the benefit to the soil, both as regards pulverization and fertility.

In ploughing-in clover or any other green crop whatever, the soil is prepared to produce well without any other manures, since by this process all the soil has produced is returned to it: with the additions resulting from the decomposed principles of air and water which are contained in the plants. I would here say that I think the advantage in ploughing-in a green crop as soon as it is fit for cutting for hay, over the same crop after it has formed its seed and become dry and hard, is very great. In order to understand fully my meaning and the belief I have expressed, that greater results follow the ploughing-in of a well-grown crop at maturity, than the same crop after it has formed its seed ; it is necessary to consider the successive changes which take place in plants during this growth ; first they produce green leaves, which by coming in contact with the air receive from it the principles of which I have spoken, or in other words carbon, oxygen and hydrogen ; afterwards the stalks increase in size and number, and are covered with numerous leaves which absorb from the atmosphere a degree of nourishment suited to the increasing wants of the plants, the strength and fulness of the leaves and stalks depending very much upon the richness of the soil.

This state continues till after the period of flowering, when a change takes place, the roots dry up, the stalks wither and change their color, and when the seeds are formed fully both

roots and stalks become nearly useless for the purpose of nourishing animals or of manuring earth.

During this process what becomes of the juices contained in the roots and stalks? They have been consumed by the formation of the seeds. Thus we see that those plants that form seeds exhaust the soil most, because for all they receive they return nothing but their dry roots and stalks, whilst those that have been cut or ploughed under while green, give back with their roots and stalks what they have drawn from the earth and atmosphere.

I am aware that some farmers do not agree with me in the conclusions I have arrived at, but we must all remember that difference of soils and of localities makes a difference in results, and in very many instances the season has to do with the same. As to the kinds of lands or soils best adapted for the use of clover, I think that where clover will not grow luxuriantly, which will be in low, wet lands, or in very light sandy soils, the endeavor to make clover a profitable fertilizer, and sufficient to redeem such lands and place them in a good state for corn or wheat or even for pasturing, would be lost labor as well as money. I think wherever gypsum or plaster can be used successfully, there we may be assured that good results will follow the sowing of this plant. If plaster should be sowed upon a piece of clover that is to be ploughed under, immediately before you commence ploughing, better results would follow than are usually acknowledged.

With these few random thoughts I will close.

Respectfully submitted for the Committee,

T. D. Thatcher.

This Essay having been read and laid over, Mr. Saltonstall submitted an Essay, as follows, upon

THE USE OF MUCK.

The term *muck* signifies in England the heap of manure which has accumulated in the straw-yard, consisting of refuse hay and straw, chaff, grass and the dung of animals which are fed in the sheds and stables of the yard. In this country the term is confined by custom to the peaty soil of swamps and to the bottom deposit of ponds. Here these two kinds of muck are very differ-

ent in the elements of their composition,—the first, meadow muck, consisting of a mass of semi-decayed trees, leaves, grasses, mosses, and plants, geine or humus; while the latter shows by analysis that far its largest component part is salts and silicates. So that they bear to each other not much stronger a resemblance than sand to black mould.

It is intended here to confine our remarks to the use of *meadow muck* or peat.

It is no easy matter to bring forward anything new upon this subject after the learned and exhaustive treatises by Dr. Dana and others, nor can any fixed or exact rules for its use be laid down for observance upon all soils and for all crops; and it is with the greatest diffidence that we attempt to make any statements upon a subject concerning which there exist so diverse opinions. Feeling convinced, however, that these rich deposits, like the coal for fuel, have been stored away by a wise Creator for enriching the farm and producing food for man and beast, and that their agricultural value—ignored until a recent period—is not now appreciated by the greater number of farmers, we will here offer our testimony in a few general remarks to the truth of most which has been written of its value as a fertilizer,—though to present more than a very few hints within the narrow limits of this paper would be absolutely impossible.

All experiments in the analysis and application of muck prove that it should never be used as an absorbent or a fertilizer in its fresh, crude state. It should be taken from its cold bed of ages, reeking as it is with stagnant water and sour gases, exposed to the frost of at least one winter and opened to the sun of one summer, before it is fit for any purpose. Whether for use in the compost heap, the pig-pen or the barnyard, the dryer it is the better its condition. Let it be dug in August, if possible, and deposited near the pit in a heap not more than three feet in thickness, remembering that it will shrink perhaps one-third in measurement and more than one-half in weight. By doing this, instead of at once carting it to the barnyard, expense in digging and in carting will be saved. Let it remain one year, if possible, before removing it, and turn it with the fork inside out after the frost leaves it, breaking up the large lumps. It is then fit to be carried to the place where it is to be used.

In digging, we have found the greatest economy in delivering

it by wheelbarrows on planks from the pit to the upland, keeping one set of hands digging, another wheeling.

It is as an *absorbent* that muck is found to be most useful, and in that quality a perfect deodorizer. Remembering that it is the manure which makes the farm profitable, and that all other things being equal, he who can spread the most good manure will prosper the best; and that the urine of cattle is unquestionably equal in its fertilizing effect to their solid excrement, every effort ought to be made to save it. It is truly a painful thing to see a farmer paying good dollars for very questionable fertilizers, while he avails himself not of the resources of his own farm. We know and are quite ready to acknowledge how great is the improvement in this respect of late years. Where all the wash of our barns and houses was once turned into the gutters and got rid of as a nuisance in the cheapest possible way, it is now, on most farms, where any degree of intelligence is brought to bear upon their management, in some measure preserved. But, alas! how imperfectly. We yet see outside the barn windows the heaps of dung, and in the yards the putrid pools of liquid manure, offending the eye and poisoning the sweet air of spring. If the owner bestirs himself to cart a few loads of crude muck, sour and dripping, to the yard, making a mire for his cattle to wallow in, and not much else, he thinks he has quite done his work, and retires for the winter, to wonder, at the next harvest, what all this talk about muck signifies. To him it has proved worthless. Now the rain, wind and sun are damaging to the liquid as to the solid, though in greater degree, urine, the most delicate of manures, being more easily deprived of all that renders it useful than solid dung. Those, then, who do not rejoice in the possession of cemented barn-cellars, where the liquid can be saved with the dung, we would urge to make a deposit of dry, well-seasoned muck, near at hand, under cover, if possible, but, if not, piled high and well covered with leaves and refuse litter to protect it from frost and rain. We say *well-seasoned*, for in its crude state it is not an absorbent, but, like a soaked sponge, can hold no more than the water already in it. Let this be used as the occasion and general plan of barn management require. If the wash be collected in a cesspool, throw in muck, as much and as often as there is anything to be absorbed, remembering it is here, espec-

ially, if the wash from the house is conveyed hither, that the best manure of the land—the true source of nitrogenous food for his crops—is made. If the cesspool has to be frequently cleaned out, its contents can be at once availed of, or can be conveyed to the compost heap; and when delivered load for load with dung from the cellar or the pen, will form a mass to please and convince the most skeptical.

Should there be no such method of carrying off the wash, cast muck, morning and evening, behind the cattle, and as often throw that which has absorbed the urine upon the dung, of course under cover. Thus not one drop is lost, and the satisfaction of knowing it is great.

It is argued by some, that it is better to cart the dung into the field mixed with the urine, and the muck, if used at all, by itself, thereby saving double carting. In rare cases, where sufficient care and judgment are used, this may be so; but we doubt it, and should always advise the other course. The solid excrement contains the woody fibre and the insoluble animal matter and salts, and the urine the more soluble salts and substances rich in nitrogen. Now, if the greatest care be not taken of the urine, it soon putrifies, its nitrogen flies off in the shape of ammonia, its soluble salts are carried away by every shower of rain; and although a *portion* of them may be saved by their mixture with the dung, yet the greater part of its volatile contents is evaporated by the action of the atmosphere. If it be allowed to drain into a tank or cesspool, it there also rapidly undergoes putrefaction; and if this be not checked, a considerable part of the ammonia produced will escape with the sulphur and phosphorus resulting from the decomposition of the salts composing those substances, occasioning the intolerable stench observed in such cases.

Now the ammonia and the alkaline and earthy salts are far the most valuable part of manure, and the former is more valuable when the cattle are fed with grains, oil-cake and other rich food. Without ammonia, if there be any truth in chemistry, no seed could be produced; and without alkaline and earthy salts neither seed nor plants could exist. How needful it is, then, that we should take good care of *all* the manure which is made upon our own farms, which certainly contains all elements of plants, and upon which we most safely may rely.

It is not, then, safe to trust these nimble workers of good—these volatile agents; but we must seize them as soon as born, and bind them to our service by the help of those coarser elements for which they have so great an affinity, before they have flitted to their kindred air.

The second method of using muck is in the compost heap. It often happens that all the dung upon a farm cannot be used at the most fitting season, and must be kept for a future occasion; that our barn-cellars or manure-sheds are insufficient to contain what is made during the season. Much care is therefore required to prevent its being wasted by fermentation or from the effect of water. Composting with muck is a most effectual mode of preserving the manure, and of adding to its most valuable fertilizing principle.

The following method of making *peat compost* is given in a treatise on peat earth, as inserted in a valuable work on Scotch husbandry:—

"The peat and dung must be thrown up in alternate strata into a heap about four feet and a half high, and in the following proportions: — peat six inches, dung ten inches; peat six inches, dung four inches; peat six inches, and then a thin bed of dung, and cover the whole with peat. The heap should be put loosely together, and then made smooth on the outside. The compost, after it is made, gets into a general heat, sooner or later, according to the weather and the condition of the dung; in summer in ten days or sooner, in winter not perhaps for many weeks, if the cold be severe. It always, however, has been found to come on at last; and in summer it sometimes rises so high as to be mischievous by producing what is called *fire-fanging*. In that season a stick should be kept in it in different parts, to pull out and feel now and then; for if it approaches to blood heat, it should be watered or turned over; and on such occasions advantage may be taken to mix with it a little fresh peat.

"The compost may then be allowed to remain untouched until within three weeks of using, when it should be turned over, upside down and inside out, and all the lumps broken; then it comes into a second heat, but soon cools and is taken out for use."

In this state the whole, except bits of decayed wood, appears

a black, free mass, and spreads like garden mould. Use it weight for weight like farm-yard dung, and it will be found to stand the comparison. Let it be observed, that the object of making up the compost is to form as large a hot-bed as the quantity of dung employed admits of, and then to surround it on all sides, so as to have the whole benefit of the heat and effluvia. Peat, nearly as dry as garden mould in seed time, may be mixed with the dung, so as to double the volume and more, and nearly triple the weight, and instead of hurting the peat, prolong it. One who has used this compost for seven years, considers it to be of immense importance. He would rather bring peat for two or three miles than want it for his compost heaps.

In this process of making compost, a large quantity of almost inert humus is broken down and rendered fit to yield abundant nourishment to plants, both in the shape of carbonic acid gas and also saline matter; while the *ammonia*, produced by the fermentation of dung, is absorbed and retained by the humus.

In all cases where good muck can be obtained, experience has shown there can be no question about the propriety and advantage of using it for that purpose. We have for ten years used this compost with the very best effect for roots and grass. As top-dressing on meadows it is better than pure dung, especially where the soil is light, leachy, or from other cause quick to suffer in dry seasons.

When horse manure is carted out in hot weather, the mode of composting is varied by thoroughly mixing with it an equal quantity of muck, instead of placing it in layers — the heap being afterward well covered with muck. This to prevent fire-fanging, which so quickly destroys it in our hot summer weather. As a preventive against the same evil, it should be liberally thrown upon the manure in the pit or pen during the summer months.

Muck can be well decomposed in various ways, by composting with lime, plaster, ashes, salt, nitrate of soda, etc.

Besides the ordinary constitution of peat or muck, which consists for the most part of inert vegetable matter, which from causes beautifully explained by Liebig, has ceased to undergo further voluntary decomposition, it often contains sulphate of iron, free phosphoric and sulphuric acids, all substances exceed-

ingly injurious to vegetation, but nevertheless capable of being neutralized and even converted into the food of plants by the action of lime, — that is, into phosphate and sulphate of lime.

Dr. Dana, in his exhaustive treatise on its uses, gives, as the simplest and cheapest compost, a cord of peat with one-third of a bushel of salt and one-third of a cask of lime, equal to solid cow dung; the cost of the same being two dollars and ten cents. And again, three cords of peat with sixty-one pounds sal ammoniac and one-quarter of a cask of lime will cost four dollars ninety-eight cents per cord.

Dr. Nichols says: "Barn-yard manure may be imitated by thoroughly composting with a cord of seasoned muck sixty-five pounds of crude nitrate of soda, two bushels of wood ashes, one peck of common salt, ten pounds of fine bone meal, two quarts of plaster and ten pounds of epsom salt" at a cost of three dollars fifty cents the cord, and "ought, other things being equal, to serve as good a purpose in the field."

"By substituting nitrate of potassa, or saltpetre, for soda, the compost is greatly improved, while its cost is enhanced. If the salts are dissolved in water, (those that are soluble,) and the bone in ley, and good muck is employed, a compost is formed very nearly as valuable as seasoned excrement. Very nearly we have said. Why is it not of equal value?"

And again, as to the importance of composting or rotting bone dust, "It should be layered with good muck or soil, and kept moist until thorough decomposition results; then it is fitted for the field." *

Our honored associate, Mr. Alexander Hyde, in his admirable essay on manures, gives the proportion, one bushel of unleached or two bushels of leached ashes to five bushels of muck, and says: "Lime also acts favorably on muck; and one bushel slaked with lime will sweeten and render fit for use ten bushels of the vegetable matter."

Thus there are various rules for decomposing, or as Mr. Hyde says, *cooking* peat or muck; to a very few only of which we have referred;—all are valuable.

The carcass of a dead horse or cow, which often is suffered to pollute the air with its noxious effluvia, when buried in muck

* Dr. Nichols' lecture before the Board, Report 1866, pp. 232–8.

with a little quicklime, is quickly converted into the most enriching manure.

Can muck be used on land to advantage without being composted? This is a question frequently asked. We answer, generally not. On sandy, light and porous soils it certainly gives, by its quality of attracting and retaining moisture, a better consistency to the soil, and renders stiff, clayey soils looser and more friable. We have also noticed that it has a strong tendency to bring in clover on grass lands.

It affords too the best possible mulch to trees, shrubs and ornamental vines, though there is danger of forcing too great a growth of wood, when used too freely around fruit trees. We have long admired its effect upon trees, but were recently astonished, on removing part of a large heap which was brought from the basin of the new reservoirs at Chestnut Hill, and deposited two years since under some old apple-trees, to find new and vigorous roots thrown out from their trunks and extending through the heap in every direction.

Our muck swamps of varying quality and depth are then of immense value to the agriculture of Massachusetts.

In our recent visit to the Island of Nantucket, as delegate from this Board to that Society's exhibition, we were greatly impressed with the vast deposits of peat on that island. There seems to be no possibility of owning a farm, even the smallest, without having within its bounds the muck for converting the sandy soil into the finest of meadow. Farmers are there too who appreciate its value, if one may judge from the great use made of it by our associate, Mr. Thompson, though we fear others (not all,) are slow to follow his excellent example. No experiments within our knowledge have been better carried out, and none in their results are more convincing as to the great and wondrous transformation to be effected on sandy soil by the free, judicious use of muck.

For ourselves, we should deem it about as wise to abandon the labor-saving machines as to give up the use of muck.

LEVERETT SALTONSTALL, *for the Committee.*

This Essay was laid over under the rule, when it was

Voted, That the time of holding the Fair of the Middlesex

Society be changed to Tuesday and Wednesday, October 4th and 5th.

Mr. Johnson then submitted an Essay upon the Time of Cutting Grass for Hay.

After a lengthy discussion the Essay was recommitted, when the Board adjourned.

FIFTH DAY.

The Board met at 9 o'clock, A. M., Mr. Birnie, of Springfield, in the chair. Mr. Bassett was appointed a committee on the credentials of newly elected members.

Voted, That the annual meeting of the Board be held at the office in Boston, to commence on the Monday preceding the first Wednesday of February, 1871.

Mr. Alexander Hyde then submitted the following Essay upon

CLIMATE AS AFFECTED BY SOIL AND LOCATION.

By climate is meant the air, as affected by light, heat, moisture, and all the gaseous and solid matters which in more or less constant proportion are ever diffused through it, as also the changes to which the air is subject. Thus we say the atmosphere of Northern Italy is brilliant, because the air passing over the Alps, has parted with its superfluous moisture and is clear, so that the sun's rays penetrate it without obstruction. On the other hand, the climate of England is proverbially moist, as the wind, which is merely air in motion, for the most part blows from the south-west and comes loaded with the moisture of the Atlantic, and being warmed by the gulf-stream, its capacity for moisture is very great, and as it comes in contact with the English hills, this moisture must be deposited. We speak of the climate of the torrid zone as hot, because the sun's rays falling perpendicularly upon this portion of the earth are more concentrated than when they fall obliquely, as they do in the temperate zones. The same amount of rays which are concentrated on a square foot at the equator, are scattered over four times this space in northern and southern latitudes, and consequently impart to the equatorial soil fourfold the amount of

heat. The air is heated slightly if at all by the passage of the sun's rays through it. The heat is conveyed to the upper regions in two modes, radiation and connection. By the former the heat passes from the earth in all directions like the spokes of a wheel and moves in an opposite direction from the wind as well as with it. Thus we feel the heat from a grate by radiation, though the air is passing directly from us to the grate. The most efficient mode of heating the great volume of air that surrounds the earth is by connection, that is, the particles of air coming in contact with the heated earth are expanded, become lighter than the other particles and consequently rise, while others take their place, and in their turn rise.

Besides the influence which light, heat and moisture exert upon the climate of a country, the air also contains quite a fraction, about one twenty-five hundredth part of its volume, of carbonic acid, which is quite a constant proportion. The quantity of ammonia in the air is very variable, being the largest after a long, warm, dry time, and the smallest after a long continued rain, as this gas is very soluble in water, and comes down with every shower to fertilize the earth. There are also various other gases constantly rising from the surface of the earth and mingling with the air, in which also float innumerable sporules or seeds, and even minute particles of metals and other inorganic matter, but in such small quantity as almost to escape the tests of the chemist.

Climatology is a subject worthy of investigation, and has not received that attention, either from farmers or scientific men, which its importance demands. In the air, as wonderfully made by our Creator, " we live, and move, and have our being." We can live without food for many hours, and even days; but we cannot live without the air a single moment. All the inferior animals and all plants are equally dependent with man upon the atmosphere for their existence. A mouse, put under the receiver of an air-pump, gasps and dies as the air is exhausted, and not a seed germinates in the ground unless the air has access to it and gives it vitality. Air is so common and such an abundant blessing that we do not think sufficiently of its value. Like water, it is so free that we forget to be grateful for it; and while it is so wisely contrived for our health and comfort, the seeds of disease and death are often, by our igno-

rance and carelessness, diffused through it, so that what is intended as our greatest physical blessing becomes our greatest curse. Next to the pollution of sin, there is nothing we should more strive against than a polluted atmosphere. In selecting a location for our farms, we are particular to select a good soil, that may furnish food for our families and for our stock. Are we as particular to select a site for our homes where the air may be pure, so that we may enjoy health, without which other blessings are little worth ? And when the site for this home is selected, are we careful to keep the air around it salubrious ? Is not the neighboring swamp too often left undrained, so that the rank growth of vegetable matter, in its decay, sends forth miasma and death ? Does not the effluvia from the barnyard or the pig-pen sometimes become a stench in the nostrils of the children, instead of being retained by some absorbent to fertilize the farm ? We are confident the cellar is the hot-bed of much disease in many houses. Cabbages and other vegetables are allowed to decay, or some putrid meat is allowed to defile the air ; or, worse still, the stench from the sink-drains, full of the seeds of death, is scattered through the house. We look into the home of the squatter, on some Western bottom land, and see the children pale and shivering with bilious fever, and although the pioneer may be surrounded with the deepest and richest soil, we pity him. In the East we are fortunately pretty much exempt from intermittent fever ; but we find many farm-houses located in low, damp situations, where the evaporation keeps the air constantly cool, or where the fog intercepts the sun's rays till he has travelled far towards the zenith.

That the climate is affected by the soil, must be patent to the most careless traveller over our hills and through our valleys. As we ride or walk, especially in the evening, we notice different currents of air—at one place dry and invigorating, and at another damp and chilly. If we study these different currents, we shall find the warm air comes over a soil naturally dry or well drained, and the cold air from some boggy meadow. We were struck with these different currents, as we, last August, after the pleasant meeting of the Board at Amherst, where we had sat sipping our tea on the piazza of President Clark, without a thought of a chilly air, we rode down the Amherst hills into the low lands of East Hadley. We felt that we had passed

into a different climate. The air of the valley was damp and chilly, and in spite of the warming influence of the president's tea, aided by a thick shawl, we could not avoid shivering.

It is a great mistake to suppose that altitude will necessarily give us a pure atmosphere. There are as many marshes and boggy meadows on the hills as in the valleys, and typhoid fevers are the scourge of our mountain towns, as they are of the borders of our lakes and stagnant waters at lower elevations. We have encountered on the Berkshire hills the same chilly air that we experienced last summer in the Hadley valley, and have uniformly been able to trace it to some marshy or damp locality near by.

The effect of soil and locality on the climate is further manifest from the earlier approach of spring and the longer continuance of vegetation in the autumn in some localities than in others of the same latitude and the same elevation. The word climate signifies in the original, a declination; and on the south side of a hill, in our northern latitude, we find a much warmer air and an earlier vegetation than on the north side, because the southern slope receives the sun's rays more perpendicularly. We have no doubt that the southern slope is also most healthy, as there is a vitality in the sun's rays aside from their heating power. We are not prepared to go all lengths with modern solar chemistry. We are not satisfied that sunshine is metallic, and that in a sun-bath, we are enveloped with elementary iron, sodium, magnesium, calcium, chromium, nickel, barium, copper and zinc. But whether light consists of minute particles of matter as we were taught in our childhood, or comes in waves as does sound as we afterwards taught, or consists of a metallic shower as some chemists now teach, we fully believe there is a life-giving power in sunshine which no farmer can afford to lose for himself, his family, his stock and his growing crops. Physicians assure us that patients on the sunny side of hospitals recover more rapidly than those on the north side, and a sun-bath is now a frequent prescription. We all know how delicately a potato vine grows in the cellar where the sunlight sparingly penetrates, and that a young lady shut up in a darkened parlor becomes about as colorless as the potato vine. We see also the sunny side of an apple having not only a deeper coloring but a higher flavor, proving that the peculiar chemical

effect of light is not confined to the surface. We therefore consider it of great importance that a farmer, in selecting sites for his house and barn, should choose a sunny place, and by no means obstruct the sun's rays by shade trees. An open lawn before the house, covered with a velvety turf, is just as ornamental as a forest, and far more healthful. Under the dense shade of trees moisture lingers a livelong summer's day, and the very shingles decay under its corrupting influence. Much more do the wife and children suffer in their delicate organizations. The yard and stables for the stock should also be on the sunny side of the barn, and the latter should be liberally glazed. A high, dry, well ventilated and thoroughly sun-lighted home should be one of the leading objects with every farmer. We have seen this winter the homes of many of the prairie farmers squatted in the mud, and are fully of the opinion that it requires much good land to compensate for the want of a gravelly knoll on which to locate one's house. The necessity of sunlight for plants is, if possible, even more necessary than for animals. The latter live upon the complicated chemical compounds which the vegetable world furnishes, but the vegetables must build up their various parts from the elementary constituents. Without sunlight the leaves of plants cannot decompose the carbonic acid of the air, assimilate the carbon and throw out the oxygen, and therefore cannot grow. It is the force of the sunbeam that tears asunder the carbon and oxygen, and gives the former for vegetable and the latter for animal life. Carbon and oxygen are therefore both the result of solar force, and some chemists attribute all force to the sun. "What moves this car?" said George Stephenson to one of his travelling companions. "The engine, of course," was the reply. "But what moves the engine?" "Steam—coal," said his companion. "No," said Stephenson, "It is neither steam nor coal, but the sun that made the coal, and is now working through it!"

But if the sun is the source of life he is also the destroyer, as his influence is constantly tending to effect change, throughout creation, a constant revolution from death to life, and again from life to death, the ultimate particles of matter undergoing no change except the change from one form of life to another. Thus viewed, corruption, putrefication and decay are only the transition state from one life to another. The sun is the great

agent in decay and in the new creation, and we do not know which to admire the most, the analysis or the synthesis. The elements of all matter are indestructible. The plants of to-day are built up of the same atoms of which plants were composed millions of years gone by. And the same is true of animals. Every particle of matter in our organization has done service over and over again, sometimes in the form of a mushroom, sometimes in the waving grain, again in the stout frame of the ox, and anon in the nobler form of a man. And all these changes have been effected by sunlight. Surely we ought to study the laws by which this great agent works, through which life comes out of death. Certainly we ought to cherish this agent in our homes, in our barns, and on our farms. Were the world deprived of the sun for one hour, universal death would be the consequence, past all hope of resuscitation. All the artificial light and heat we enjoy are but the reproduction of sunlight and sun-heat treasured up in some form of carbon; but how inadequate is this reproduction for heating and lighting the earth.

Not only must a sunny spot be selected for a home, but the soil must also be considered. This leads us to say that a sandy loam will be from a week to a fortnight earlier than a stiff clay loam in its vegetation. In the same latitude and elevation we have seen in one place winter lingering in the lap of spring, with large snow-drifts for her pillow, while in another a few miles remote, the grass was green, the dust flying, and the boys playing ball. We need not add that this difference of climate was occasioned by the soil in the one place being of a cold clay, and in the other of a warm sandy loam. Which is the preferable soil for cultivation, and which is the preferable climate for health and comfort, we leave for every farmer to decide.

We cannot, however, all live on the most easily tilled land nor in the most favorable climate. The Creator in his infinite wisdom has made every variety of soil, so that man's ingenuity might be taxed to the utmost and his manhood thus developed; and we propose, in order to make this essay as practical as possible, to notice the effect that drainage has on the temperature of the soil, and consequently upon the climate of a country. Experiments upon these points have not been as extensive or accurate as we could wish, but some seven years since the Mar-

quis of Tweeddale offered $400 for the best experiments on the difference of drained and undrained land at different depths below the surface. The temperature of the drained and undrained lands was to be observed in pasture lands at the depth of ten inches, and in arable lands at ten, twenty and thirty inches below the surface, and in both cases to be compared with the temperature of the air four feet above the soil. The drains were to be two and one-half feet deep, and the drained and undrained lands were to be as similar as possible both in chemical and mechanical composition. The results proved that the drained lands at the depth of ten inches have an average temperature of two to three degrees above those undrained. During a warm rain the temperature of the undrained soil was the higher, as the water does not percolate through the soil and pass off. At the depth of twenty and thirty inches the effect of warm rain is not felt and the temperature of the drained soil is uniformly higher, and the great advantage of drainage becomes more strikingly evident. In the winter and in periods of cold weather in the spring and autumn, the drain serves a better purpose in elevating the temperature than during a long continued warm season. It may be worth while to remark that the ground is heated in two modes: by the sun's heat from above, and the external heat of the earth from below, and at some periods the heat is increasing from the surface downwards, and at others is passing from below upwards. Undrained land having the interstices between its particles filled with water is less porous and therefore a better conductor of heat to the outer air, and hence its temperature falls rapidly when the air becomes cooler than the land; but on the other hand, when land is saturated with moisture it is almost impossible to conduct the heat of the air downwards, as fluids do not convey heat from particle to particle as do solids, but by a change of place, the heated particles rising and the cold descending. Every house-wife knows that she cannot boil her tea-kettle by placing the fire over it, and every farmer should know that he cannot make moist land warm by surface or sun heat.

Besides the impossibility of conducting heat downwards through water, except in quantities so minute as to require nice experiments to detect its descent, the evaporation going on has a tendency to produce cold. Just as soon as a surface drop of

water becomes so warm as to be converted into vapor it acquires a vastly increased capacity for storing away latent heat which it absorbs from all surrounding objects. For this reason the hands of the washer-woman wet with warm water freeze so quickly while hanging out her clothes, and for the same reason the low wet places suffer from the first frosts of autumn. We have noticed the crops on wet lands injured by the frosts of September, while near by on well drained land they escaped all damage.

On the wet places also the fogs make their first appearance and continue the longest. However transparent the air it always contains aqueous vapor, and the higher the temperature of the air the greater the amount of vapor it is capable of containing. When the air comes in contact with any body 40° colder than itself its capacity for retaining the moisture is so reduced, that the vapor becomes instantly visible. Thus the moisture of our breath is instantly turned into vapor, as it leaves our mouths of a cold winter's morning, and the vapor of a locomotive in a cold day makes a beautiful cloud which lingers long after the train has departed. For the same reason when the air comes in contact with cold moist land, the vapor which before was latent becomes visible and causes the dismal, shivering fog. This nebulous appearance when examined by a microscope or illumined by the sun with a dark back ground is found to be composed of an infinity of minute watery vesicles. They group themselves in the form of spherules and obey the law of gravitation, being densest near the surface of the earth. Fogs are often seen on a river in a cold winter morning, when the water of the river being warmer than the air, the vapor rising becomes visible. When the land is naturally dry and porous or is made so by drainage fogs seldom intercept the sun's rays and make the air damp and chilly. The warm air penetrates such a soil, giving life and breath to the plants and the climate is equally healthy, for man and beast. The porous nature of some of our Western prairies especially in Kansas, makes the air delightfully clear and dry. After a rain the land becomes speedily dry and the air pure. We recently asked an aged but hale-looking friend how long he had lived in Kansas. Ten years was his reply, and I am ten years younger than when I came here. We cannot hope to make our soil as deep and

granulated as that of the prairie, but he who drains it thoroughly will do himself and the country great service.

The effect which trees have in protecting land from cold winds, and influencing the humidity of the soil and the atmosphere is another consideration well worthy of the attention of farmers. It is well to know that the rivers of our country have diminished in size as the forests have disappeared. Our memory runs back only half a century, but in this time the hills of Berkshire have been stripped of their trees to furnish coal for the furnaces and fuel for the locomotives and factories, and the consequence is that where we plunged headlong into the Housatonic while bathing in our boyhood, a frog is compelled to jump obliquely, or he will strike his head against the stones. The freshets are about the same as of old, but the water passes off more rapidly from the land not being detained from evaporation by the dense forests, nor from flowing into the streams by slow percolation through the leaf mould. The drainage of our swamps and moist lands has also aided the quick transit of the rains and melted snows. The history of all nations proves that with the destruction of the forests comes a less fall of rain and often sterility. The land of Canaan, which in the days of the patriarchs flowed with milk and honey, now shows but little evidence of her ancient fertility. The valley of the Euphrates was once famous for its exuberant vegetation, but the traveller now looks in vain in this valley for the fertile soil, which formerly supported a teeming population. The coasts of Africa were once green with forests, and in consequence of their destruction we now see only barren sands. In France and other European countries the same destruction of timber lands and consequent barrenness can be noticed. The wide wastes of Brittany and the deserts of Champagne were, in the days of the invasion of Gaul by Julius Cæsar, covered with forests, and the conqueror says they were among the most fertile lands.

This subject has engaged the attention of the French government, and laws have been made against the destruction and in encouragement of the planting of trees, but in spite of law it is found that about 75,000 acres of forest are annually cut over and only 25,000 acres planted. In the last 100 years France has diminished her forest lands by five millions of acres, nearly one-fourth of her wooded surface, and a more stringent law has

recently been enacted to preserve the forests. That the total rain-fall and—what is of more consequence so far as the climate and fertility of a country are concerned—the frequency of showers, are greater on a well wooded tract, than on sandy soils destitute of trees, is well established, for an associate on this committee, Mr. Thompson of Nantucket, says he has often noticed the showers falling on the wooded parts of that island while the denuded sandy portions were left unrefreshed. If we could once cover the desert of Sahara with forests or even with grass to cool the air, we should expect the showers to descend there, bringing, as they do everywhere, fertility to the soil. The foliage of trees and grasses defends the soil from the sun's rays, and thus prevents the ground from becoming heated, while a warm sandy soil radiates its heat and thus hinders the condensation of the moisture of the atmosphere and the descent of refreshing showers. Not even dew is deposited on sandy soil, and the contrast between Gideon's dewy fleece and the surrounding dry land was not greater, than between such a soil and one covered with green herbage on a cool night in August.

We therefore recommend to the farmers of Massachusetts to spare the trees, if they wish to encourage the descent of the fertilizing showers. On many of our old rocky pastures, where the vegetable and saline matter has been slowly diminishing for centuries, trees will grow spontaneously if cattle will allow them, and no better treatment of these pastures can be recommended than to let them grow up to forests. The soil will not only thus be restored to its virgin fertility, but the climate will be greatly ameliorated. In the western part of Massachusetts, we find many of our old pastures growing up to white pines, and we hail their growth as the dawn of a more healthy era. The aroma of a pine forest is full of healing virtue to the lungs, and we confidently expect that the form of consumption, which our physicians call phthisis, will decrease as these pine forests increase. There is no better tree than the white pine to plant between the house and the barn-yard, to prevent the passage of all effluvia, or on the north-west side of the house to keep off the cold winds of winter, or on the west and north of the garden and orchard, so that the vegetables and fruits may bask in the sunshine undisturbed by the gales of summer.

We are conscious of not having done justice, in this short

essay, to the subject of climatology. We thought when the subject was given us for investigation, that we should say nothing upon it, for the good reason that we knew nothing to say; but observation and study have magnified its importance, and we commend it to the careful consideration of our farming community and all others interested in the health of the climate and the fertility of the soil.

ALEXANDER HYDE, *Chairman.*

This Report was accepted, when Dr. Pierce presented a Report upon Abortion in Cows. After full discussion, during which many interesting facts were elicited, the Report was recommitted to the Committee.

The Essays upon the Use of Muck, upon the Preparation of Soils, and upon Clover as a Fertilizer, were then taken up, read a second time, and accepted.

The Reports of Delegates were also read and accepted.

Adjourned.

SIXTH DAY.

The Board met at 9 o'clock, A. M.

Present: Messrs. Baker, Bassett, Bradford, Boise, I. K. Brown, N. P. Brown, Bucklin, Clement, Ellsworth, Goodman, Hubbard, Hyde, Johnson, Knowlton, Loring, Moore, Morton, Peck, Pierce, Saltonstall, Slade, Stone, Thompson, Ward and Wilder.

Mr. HUBBARD, of the Worcester South Society, was requested to preside, and accordingly took the chair.

Mr. Bassett, for the Committee on Credentials, submitted the following

REPORT:

The Committee on Credentials have attended to that duty, and respectfully report that the following delegates are duly elected for this year:—

By the Middlesex Society, . . .	. JOHN B. MOORE.
Worcester South-East, .	. WILLIAM KNOWLTON.
Hampden, ...	. WILLIAM BIRNIE.
Hampden East, . . .	. H. CONVERSE.
Berkshire, ...	. ANDREW J. BUCKLIN.

By the Hoosac Valley,	NAHUM P. BROWN.
Housatonic,	RICHARD GOODMAN.
Bristol Central,	NATHAN DURFEE.
Hingham,	ALBERT FEARING.
Marshfield,	GEO. M. BAKER.

Respectfully submitted.

C. C. BASSETT.

Messrs. Goodman and Saltonstall were added to the committee appointed to consider and report a List of Subjects for Essays.

Mr. Bradford, from the Committee appointed to consider and report upon the time and place of holding the next country meeting of the Board, reported that it was advisable to hold the meeting at Framingham, beginning on the first Tuesday of December next.

The Report was accepted, and the place and time fixed accordingly.

The Committee on Meetings was then constituted by the appointment of Messrs. Wilder, Johnson, Stone, Moore and Slade.

The Visiting Committee of the Massachusetts Agricultural College was constituted by the appointment of Messrs. Agassiz, Goodman and Stone.

The delegates to attend the exhibitions of the various societies were appointed, as follows. To the

Essex,	RICHARD GOODMAN.
Middlesex,	ALBERT FEARING.
Middlesex North,	NAHUM P. BROWN.
Middlesex South,	A. P. SLADE.
Worcester,	I. K. BROWN.
Worcester West,	E. STONE.
Worcester North,	W. S. CLARK.
Worcester North-West,	L. H. BRADFORD.
Worcester South,	L. SALTONSTALL.
Worcester South-East,	A. P. PECK.
Hampshire, Franklin and Hampden,	J. JOHNSON.
Hampshire,	G. T. PLUNKETT.
Highland,	G. M. BAKER.
Hampden,	M. P. WILDER.
Hampden East,	A. CLEMENT.
Union,	J. PIERCE.
Franklin,	T. W. WARD.

Berkshire,	W. Knowlton.
Housatonic,	G. B. Loring.
Hoosac Valley,	G. A. King.
Norfolk,	J. T. Ellsworth.
Bristol,	C. C. Bassett.
Bristol Central,	A. J. Bucklin.
Plymouth,	W. Birnie.
Hingham,	N. S. Hubbard.
Marshfield,	J. F. C. Hyde.
Barnstable,	O. Warner.
Nantucket,	J. A. Morton.
Martha's Vineyard,	E. W. Boise.

Voted, To appoint a committee of three to appear before the legislative Committee on Agriculture, to oppose the repeal of the bird law of this State, so far as it relates to the smaller land birds.

Messrs. Saltonstall, Hyde and Stone.

Voted, To appoint a Committee on Printing.

Messrs. King, Plunkett and Stone.

Mr. Saltonstall, from the Committee on Subjects, then submitted the following list of subjects, which were assigned to committees, as follows :—

Breeding of Domestic Animals.—Messrs. Agassiz, Plunkett and Goodman.

Nature's Mode of Distributing Plants.—Messrs. Clark, Wilder and Durfee.

Abortion in Cows.—Messrs. Pierce, Agassiz, I. K. Brown and Ellsworth.

Time of Cutting and Curing Hay.—Messrs. Johnson, Saltonstall and Ellsworth.

The Culture and Preservation of Fruit.—Messrs. Wilder, Hyde, Clement and Knowlton.

Methods of Draining.—Messrs. Plunkett, Slade and Loring.

The Damages and the Good done by Birds.—Messrs. Clark, Saltonstall and Bucklin.

The Use of Capital in Farming.—Messrs. Stone, Hubbard and Clement.

Market Gardening.—Messrs. Moore, Slade and N. P. Brown.

On the Value of an Agricultural Training for Women.—Messrs. Goodman, Wilder and Birnie.

The Best Mode of Preventing the Injuries to Vegetation from Insects.—Messrs. J. F. C. Hyde, Saltonstall and Peck.

On the Value of a Regular System of Farm Accounts.—Messrs. Bradford, Bassett and Ward.

This Report was accepted and adopted.

Voted, That a Committee of three be appointed to report upon the Necrology of the Board. Messrs. Bradford, Goodman, and the Secretary.

Voted, That the Committee on Roads and Road Making be authorized to report directly to the legislature.

Mr. Saltonstall, for the Committee to which was referred the paper relating to Farmers' Institutes, having submitted a Report upon the merits of the proposition, and recommended its reference to a Committee to consider and report at the next annual meeting, it was so

Voted, To refer the subject to a Committee of three, consisting of Messrs. Loring, Pierce and Slade.

Voted, That all unfinished business be referred to the Committee on Printing with full powers.

Mr. Wilder, on behalf of the Committee, then submitted the following Report on

FRUIT CULTURE.

The undersigned, concurring in the principles and practice set forth in the lecture by Mr. Wilder, before the Board of Agriculture, at their meeting in Pittsfield, would, however, call attention to a few of those considerations, which are deemed most necessary for the successful cultivation of fruits.

Among these, we would name as important,—

The thorough and perfect drainage of the land, either natural or artificial.

The proper preparation of the soil, clean cultivation, and constant care of orchards.

The necessity of excluding grass, grain and all other crops

from orchards, except, perhaps, a few vegetables, while the trees are young.

The importance of regular manuring of fruit-trees, as well as other crops, and of its application in the fall, on or near the surface, so that the rain, snow and frost may prepare and convey its elements to the roots.

The great advantages to be realized by the proper thinning of fruit, thereby improving its excellence, increasing its value, and preventing the evil effects of overbearing, which always result in injuring the constitution and shortening the life of the tree.

And lastly, your Committee would suggest that clean culture, without destruction of the roots by deep ploughing or spading, and that constant care and vigilance are the indispensable conditions of success in fruit culture.

In conclusion, your Committee would recommend for cultivation the following select list of fruits, as adapted to seasons of maturity and to most sections of our State:—

APPLES.

Summer.

Early Harvest. Requires a warm, rich soil.
Red Astrachan.
Williams Favorite.

Autumn.

Foundling.
Porter.
Gravenstein.
Holden Pippin.
Mother.
Hubbardston Nonesuch.

Winter.

Rhode Island Greening. Requires a good soil.
Baldwin.
Roxbury Russet. Requires a deep, rich soil.

PEARS.

Standards on Pear Roots.

Clapp's Favorite. Large. Should be gathered by Aug. 25.
Brandywine. Early and productive.

30

Bartlett. Succeeds throughout the country.

Doyenné Boussock. Prolific and profitable.

Belle Lucrative. Rich. Does not color as well as some.

Buffum. Very vigorous and productive.

Urbaniste. One of the best autumn.

Merriam. Golden russet. Fine market variety.

Onondaga. Good for market.

Lawrence. Popular winter sort.

Beurré d' Anjou. Early winter. The best acquisition of the age.

Vicar of Winkfield. Hardy, fine tree; superior for cooking, and frequently good for the table.

Dwarfs on Pear or Quince Roots.

Louise Bonne de Jersey.

Duchesse d' Angoulême.

Urbaniste.

Vicar of Winkfield.

GRAPES.

Delaware. Small, early, rich. Requires a warm, generous soil.

Hartford Prolific. Early.

Massasoit. (*Rogers' No.* 3.) Early.

Wilder. (*Rogers' No.* 4.) Ripening about September 20.

Concord. Ripening about September 20.

Merrimac. (*Rogers' No.* 19.) Ripening about Sept. 20.

All of which is submitted, by

MARSHALL P. WILDER.
ASA CLEMENT.
JOHN B. MOORE.

This Report having been accepted, it was

Voted, To accept a paper upon Insects Injurious to Vegetation, prepared and submitted to the Board by Dr. A. S. Packard, Jr., and that the thanks of the Board be presented to Mr. Packard for this valuable contribution to the science of entomology.

The Board then adjourned.

NEW OR LITTLE KNOWN INJURIOUS INSECTS.

BY A. S. PACKARD, JR., M.D.

Some of the insects described below have been known for some years to be dangerous pests in our orchards and gardens, while others are described which are new to science, and have only recently obtruded themselves on the notice of agriculturists. Each year witnesses the inroads of new depredators on our fruits and field crops, while entomologists are detecting each year the presence of new insects which prey upon forest-trees, unknown to farmers themselves. The present contribution to applied entomology is offered in the hope that farmers and gardeners may give increased attention to the habits of noxious insects, and that improved means of withstanding their attacks may be devised, and a knowledge of practical, or economical, entomology be more widely disseminated. Most of the specimens mentioned are contained in the Museum of the Peabody Academy of Science, Salem.

INSECTS INJURING THE APPLE.

The Apple-Bud Moth.—The most injurious enemy of the apple-tree, next to the canker-worm, that we have in this state, is a small, reddish-brown larva, which, during the spring of the present year, threatened, in some localities, the extinction of our apple crop. It was described by Harris, in his "Treatise on the Insects injurious to Vegetation," (third edition, p. 481,) under the name of *Penthina oculana*, and should now be named *Grapholitha oculana.* The caterpillar is a small, cylindrical, naked worm, about a third of an inch in length, and of a uniform reddish-brown, with small warts, from which arise short, fine hairs, while the head and upper side of the prothoracic ring, or segment next the head, is black.

On the 15th of May, a partially grown larva was brought to me by a gentleman in Salem, and afterwards, (May 17,) receiving others from Mr. W. C. Fish, of Sandwich, we published a brief account of it in the "American Naturalist," a monthly magazine of natural history, published by the Peabody Academy of Science, at Salem. We at this time supposed it to be an undescribed species, until specimens of the moth, reared by Mr.

F. W. Putnam, who has studied the habits of this moth considerably, were found to be Harris's species.

May 16th, I noticed this caterpillar on the apple, and also the pear and cherry, perforating the half expanded leaf and flower-buds. They were very abundant on these buds, and afterwards, when the leaves had partially expanded, they had folded the leaf. It seems to hatch out about the time that the canker-worms and American tent caterpillars leave their eggs, that is, about the first day of May, when the buds unfold. The last of May and the first week of June they were swarming in orchards throughout Essex County, many persons noticing their attacks; and it seems to be a common insect all over the State. When fully grown, it crumples the leaves, disfiguring the whole tree, and doing great damage to the fruit-buds and flowers, thus directly lessening the apple and pear crop. About the first of June they cease eating, and make a loose, delicate silken cocoon in the folded leaf. They remain several days—sometimes nearly two weeks—in this state, before assuming the chrysalis state, which, as Mr. Putnam observed, occurred June 16, and the moths are seen flying about and entering houses, attracted by the light within, during the last week of June and the first of July. The chrysalis is brown and of the usual shape, and, as Harris states, has but a single row of teeth along the dorsal side of each abdominal segment. After the moth has slipped out of the pupa case, the empty shell remains attached by the tip of the abdomen to the surface of the leaf.

The moth is closely allied to the *Grapholitha cynosbatella*, (*G. ocellana*,) of Europe. The body is dark ash color, the fore wings being usually paler in the middle. The basal third of the wing is dark ash mottled with paler scales, the outer edge of the dark area being angulated just behind the middle of the wing. The costa is marked with light and dark bands. On the outer third the wing is nearly as dark as on the base; near the outer edge, and half way between the costa and hind edge, are four well-marked longitudinal black spots, or short lines running parallel with the costa, or front edge, of the wing; the one nearest the costa is simply an elongated dot, the second and largest is an oblong spot and twice as wide as the third spot, while the fourth again is much smaller. There are three sim-

ilar black marks situated on the inner edge at the outer third of the wing. When the wings are folded over the back, these black marks, collectively, make a rudely triangular figure. The outer third of the wing is also variously banded and mottled with leaden blue and tawny brown scales. The fringe is brown and leaden blue. The hind wings are dark ash brown. Beneath, the fore wings are not mottled, but uniformly dark ash brown, and a shade lighter than the upper surface of the hind wings. It expands about .55 of an inch.

It varies in the distribution of the black spots, and in the degree of angularity of the outer edge of the basal dark portion of the fore wings; and in some specimens the middle of the wing is concolorous with the other parts, and the peculiar leaden blue scales are scattered over the whole wing, with a black patch on the inner third of the wing near the inner edge. In some specimens there are more than four dots near the outer edge of the wing, forming a transverse row.

As these worms attack the fruit and leaf-buds, it is difficult to pick them off by the hand without injuring the buds; nor is it easy to apply whale-oil soap or a weak solution of carbolic acid. Both of these remedies, however, should be tried, especially showering the terminal branches of the tree with soap-suds or a very weak solution of carbolic acid. A faithful application, for one season, of these and other remedies, will materially lessen the numbers of this formidable pest.

The Apple Micropteryx.—This minute moth has been very abundant, mining the leaves of the apple in September and October. It eats its way in the interior of the leaf between the upper and under side, feeding upon the parenchyma. Its burrow is marked by a wavy broad dark line on the leaf, which dilates at the end into a spatulate expansion, somewhat puffed out, in which the larva rests when fully fed, and makes its exit through a slit at the end, when it may often be seen hanging suspended by a thread. The larva is a minute, deep green caterpillar, cylindrical, somewhat flattened, with the sutures between the segments well marked; the body is thickest in the middle and is very soft. It is about one-tenth of an inch long. It may be seen in abundance hanging from the leaves during September and early in October, when it matures, and in October spins a peculiar flattened orbicular silken yellow cocoon about a tenth

of an inch in diameter on the bark of the branches and twigs. In confinement it will make its cocoon on leaves, but in nature it is careful to deposit them on the branches, where it remains through the winter. The larva completes the cocoon, at least all that is visible, within the space of one hour. The upper side overlaps the under side, leaving an open slit between the top and bottom. The under side is quite free from the top, and is oval elliptical. The moth was found in considerable abundance resting on the under side of apple-leaves the 19th of June.

Sometimes five or six larvæ will mine a single leaf, thus defacing the tree. They have been abundant at Salem, and I have seen their mines at Amherst. The habits of this genus are not well known as yet so far as I am aware. This species is undescribed, and may bear the name of *Micropteryx pomivorella.* It is closely allied to *M. calthella* of Europe, though not much more than one-half as large. The fore wings are long ovate, with a long silken fringe, while the hind wings are very narrow, acute, and the fringe at the base of the wing half as long as the wing itself; the body is very short and small, and the antennæ about one-half as long as the fore wings, and on the head is a loose spreading tuft of uneven hairs. The body and wings are of an uniform dark bronze hue with purple and metallic reflections; the fringe is concolorous with the wings. On top of the head is a conspicuous bushy tuft of bright reddish orange hairs. The legs are of a leaden hue, the hairs yellowish, the hind tibiæ long and hairy, with four long, slender spurs; the antennæ dark on the terminal three-fourths, pale orange at base. The palpi are leaden gray, concolorous with the legs. The under side of the wings are leaden gray. Length of the body .07, of the body including folded wings, .10 of an inch.

INSECTS INJURING THE CHERRY.

The V-marked Tortrix.—This is not an uncommon moth. Mr. F. W. Putnam has raised it in abundance from the cherry, and it has been detected at Portland, Maine, by Mr. E. S. Morse. It enters our houses at night during July. Unfortunately nothing is yet known of its early stages. It may be named *Tortrix V-signatana.*

The head and thorax are tawny, with paler scales on the hinder edge of the thorax, concolorous with the broad tuft at

the tip of the abdomen in the male. The fore wings are pale tawny, mottled with reddish brown scales; on the costa are two pale, almost silvery spots, one on the inner third of the costa, which is triangular, with one point resting on the costal edge, and another pointing towards the base of the wing. Just beyond the middle of the wing is a prominent triangular silvery spot with the base on the costa; a V-shaped brownish band encloses this spot, the apex of the V being prolonged towards the inner angle of the wing. Within the V-shaped spot is an oblong brown spot lying across the wing, though not reaching either the costal or inner edges. The outer edge of the wing is more decidedly tawny, and paler on the edge. There is a subapical oblique silvery band, and one parallel, but shorter, lying next the apex of the wing. The fringe is paler than the wing. The hind wings are dark ash, with the fringe paler. Beneath, the wings are pale tawny, the fore wings being rather darker. The body is .35 of an inch in length, and the wings expand .75 of an inch.

The Cherry Coleophora.—This is a new species of this genus which I would propose to name *Coleophora cerasivorella.* The wings are shorter and broader than others of the genus, and the base of the antennæ are smooth, being without the usual tuft of scales. It is of an uniform dark stone gray. The antennæ and head are whitish gray, the former annulated with white; they reach to the outer third of the wing. The head is smooth and rounded above, the scales lying flat on the surface. The legs pale gray; the hind tibiæ very hairy, with four long spurs. The wings have no markings, being dark gray with darker scales. The hind wings are very narrow with a long fringe. The body is .14 of an inch long, and the wings expand .42 inch. It feeds on the leaves of the cherry in Salem.

INSECTS INJURING THE CRANBERRY VINE.

The glistening Cranberry moth.—Of the extensive genus Tortrix three species have been found to prey on the cranberry. The present species is said by Mr. F. G. Sanborn, to prey upon cranberry vines. We have briefly described it in our "Guide to the Study of Insects," under the name of *Tortrix oxycoccana.*

It was found flying, October 4th. The body is of a dark slate color, and the palpi, which are large and project well beyond

the head, are of the same color, with a few bright reddish scales at the end of the second joint. The tuft of hairs on the tip of the abdomen are much paler than the rest of the body, and of the same color as the legs and the hind wings, being of a glistening gray color. The fore wings are of an uniform reddish brown color, with a peculiar glistening, or greasy, hue; the red tint is due to scattered bright red scales; there are no other spots or markings on the wing, and the fringe is mottled with red and gray scales as on the wings; on the hind wings the fringe is long, silky, glossy, grayish white. Beneath, the fore wings are pale gray, the hind wings being paler than the fore wings. Length of the body .25; expanse of the wings, .64 of an inch.

It may be readily known by the peculiar shining, greasy look, and by the brick red scales scattered over the plain, unadorned fore wings. The habits of the caterpillar are not known.

The red-banded Cranberry Tortrix.—This Tortrix, described by Dr. Clemens under the name of *Tortrix incertana*, has been sent to Mr. Sanborn by Miss Guild of Walpole, Massachusetts, where its larva is called "the cranberry worm." According to Mr. C. T. Robinson it is found in Texas, and northward to Ohio and Pennsylvania, as well as Massachusetts.

The body and fore wings are deep reddish brown. The palpi are prominent, projecting farther than usual in front of the head. The head and thorax are ochreous brown, with a large tuft of red hairs on the hinder margin of the thorax. The fore wings are reddish brown, and at the base clear light reddish brown bounded behind by a curved broad dark brown band, which terminates just below the median vein; between this and the broad brown red band and situated on the inner edge of the wing is a dull silvery equilaterally triangular spot. From the middle of the costa runs to the outer angle of the wing a broad dull red band one-half as wide as the wing, and suddenly narrowing on the costa. Beyond, is a narrow hemispherical dark red costal spot. Beyond the broad band the outer edge of the wing is clear silvery, except an oval brown spot. The fringe is reddish, silvery on the inner margin. The hind wings are pale, smoky, concolorous with the under side of the fore wings, while the under side of the hind wings is whitish. It expands .70 to .80 of an inch.

In the pupa the segments of the abdomen are divided by deep sutures, the edge being angulated, and with two dorsal rows of unusually small spines. The tip is prolonged into a long point, nearly twice as long as wide, and giving rise to three pairs of curved minute filaments. Length .34 of an inch.

The yellow Cranberry worm.—August 4th I received from New Jersey, through Mr. S. H. Scudder, specimens of this insect in all its stages, under the name of the "Cranberry worm." It seems to be a common insect in the cranberry fields of New Jersey, but has not yet been found in the New England States. It is new to science and may be called the *Tortrix vacciniivorana.*

The larva draws the leaves together with silken threads, transforming into a pupa within the mass. A single larva seems to select one twig, or branch, and eats the parenchyma from the upper surface of the leaves, until every leaf or twig is injured, and the plant nearly as much destroyed as if the leaves were eaten up entirely. In this way each larva seems to eat the best part of about twelve leaves, which usually remain on the stalk affording a shelter to the pupa, which is naked, partly sticking out of the leaves.

The larva is pale honey yellow, with a slight greenish tinge. The head and prothoracic shield is pale honey yellow, and the head is nearly as wide as the prothorax. The body tapers gradually to the tail, and is furnished with fine sparse pale hairs arising from prominent tubercles, the hairs being one-half as long as the body is wide; the four dorsal tubercles are arranged in a trapezoid, with a deep crease between the anterior and posterior pair. The thoracic feet are tipped with black. On each side of the base of the head is a lateral S-shaped blackish brown linear band, the upper part of the S terminating on the top of the occiput, the line being most distinct on the side of the head. The ocelli are black. It is .27 of an inch in length.

The pupa is brown, rather slenderer than usual, with the vertex of the head prolonged into a large tubercle, surmounted by a round knob which is rough, while the tubercle below is smooth; there is an angular projection on each side of the base of the tubercle, forming a shoulder to it. The wing-covers reach to the end of the third abdominal ring, while the antennæ reach to the end of the second pair of feet, which are parallel to

the end of the second abdominal ring. There are two rows of teeth on the upper side of the abdominal rings; they are obsolete beneath, the posterior row being indicated by two remote minute tubercles. Length .25 of an inch.

The moth is rather undersized, with yellow wings, without any decided markings, but mottled with deep ochreous. It expands one-half of an inch.

The Cranberry Weevil.—(Pl. 1, fig. 10, enlarged; 10*a*, larva, enlarged.) Mr. W. C. Fish has found this insect preying on cranberry buds, and communicated to me an account of its habits. It was identified by Dr. J. L. Leconte as *Anthonomus suturalis*, Lec., and I extract the following description of it from my "Guide to the Study of Insects," p. 487: "It is a minute reddish-brown beetle, with the beak one-half as long as the body, just beyond the middle of which the antennæ are inserted. The head is darker than the rest of the body, being brown black. The thorax is a little darker than the elytra, and covered very sparsely with short whitish hairs; the scutellum is whitish, and the elytra are shining reddish-brown, with the striæ deeply punctured, the interstices being smooth. It is .13 of an inch long, including the beak. Mr. W. C. Fish detected this little weevil laying its eggs in the buds of the cranberry. It selects a bud not quite ready to open, and clinging to it, works its snout deep into the centre of the bud. An egg is then deposited in the hole made, when the beetle climbs to the stem and cuts it off near where it joins the bud, which drops to the ground and there decays, the egg hatching and the grub going through its transformations within. The larva is long and rather slender, cylindrical, the body being of uniform thickness and curved; the head is pale honey yellow; the jaws tipped with black; the segments of the body are very convex, especially the prothoracic one; it is white, with a few fine, pale hairs, and is .08 of an inch in length."

Mr. Fish, in an article on this insect, published in the "Yarmouth Register," states, in addition to what we have said above, that the "egg, which may be found within the bud, is pale honey yellow, and is very minute, measuring but .02 of an inch. The egg hatching, a dull whitish grub will be found feeding within the bud. Having attained its growth, it changes to a pupa, and the perfect weevil eats its way out of the bud, leav-

ing a round hole in the side. These beetles may be found upon the vines some time after the blossoms have disappeared. I have known them to eat into a cranberry, making a round hole large enough to admit the insect; but it is seldom that it does this. It also eats a little upon the under leaves, but I have never known it to deposit its eggs within the fruit, and I have never found the grub elsewhere than in the bud. I have taken this beetle upon the fruit of the blackberry, in company with other species of Anthonomus.

"This insect is not numerous anywhere, but is more common at Eastham than at any other locality that I have visited. As I have never seen one upon a bog that had been flowed during winter, I think that it will never become troublesome on such bogs at least. The larvæ are killed by a minute chalcis fly, as I discovered the past season."

INJURING THE CURRANT.

The cross-lined Chærodes.—This is not an uncommon moth, which I suspect feeds usually on the maple, but has been detected by Mr. F. W. Putnam feeding on the currant, specimens in the Museum of the Peabody Academy being thus labelled: "Larva on the currant the last of July. Moth appeared August 6th." It makes a loose silken cocoon within a rolled up leaf.

It is the *Chærodes transversata* Walker, and is a large, fawn-colored moth, expanding two inches, and the apex of the fore wings is somewhat sickle-shaped, while both wings are angulated in the middle of the outer edge.

The body and wings are uniformly fawn-colored, the costa of the fore wing being a little lighter and crossed by small linear dark brown spots. A slightly waved line crosses the fore wings just before their middle, and is much curved outwards below the costa, and at the outermost point of this angle is a minute black dot, consisting of a few black scales. Another line, edged externally with whitish scales, crosses the wing, beginning on the outer third of the inner edge, running obliquely to near the apex, when it makes an acute angle, and reaches the costa a short distance from the apex, which is sharp. On the hind wings is a similar straight line situated just within the middle. The wing is angulated in the middle, and slightly hollowed out beneath the angle. The head is whitish between the antennæ,

which are whitish on the under side. Beneath, the wings are gray fawn color, whitish on the apex, along the inner edge of the fore wings, and along the outer edge of the hind wings.

The Currant Halia.—For several years I have noticed the *Halia wavaria* Gœdaet flying in our fields and gardens, and at length succeeded in raising it from the caterpillar found on the currant. It is a common European moth, and is likely to prove destructive to the currant in this country. I neglected to describe the caterpillar, which is a span worm, like the common currant caterpillar in its general form, and translate from Guenée's work on moths the following description of it:—

"Caterpillar quite short, cylindrical, head globular, a little flattened, of a pale green, with the back occupied by four waved lines and marbled with yellowish white. The line near the stigmata is of a lively yellow, and widens in the middle of each ring. From all the warts arise black hairs, the ventral warts being well marked. The stigmata are black, and liable to be confounded with the warts. Head green, punctured with black. It lives, in May and June, on the *Ribes grossularia*, the leaves of which it destroys. The chrysalis lives in the earth."

The moth has triangular fore wings, with the apex rather obtuse, and the outer edge entire, not being hollowed out just below the apex, as in the allied genus Macaria. Along the costal, or front edge of the wing are four large brown spots, the second one forming a line crossing the wing, in the middle of which it is distinctly angulated; near the apex is a squarish patch; the fore wings are pale ash, a little darker along the outer edge, while the hind wings are paler, with the outer edge rounded. It expands a little over an inch and a quarter.

INJURING THE RASPBERRY.

The Byturus unicolor Say, (Pl. 1, fig. 12, enlarged,) is a little sub cylindrical beetle about .15 of an inch long, and resembles the death-tick, or Anobium, a pale, reddish-brown beetle which is found in our houses. The whole body and limbs are reddish-brown, and covered with dense, rather long, pale, tawny hairs. The surface is thickly punctured. The scutellum is paler than the rest of the body and very conspicuous. The eyes are black, and the margin of the thorax is rather broad and much depressed, the disc being high and convex. It is

also distinguished from the larder beetle (*Dermestes lardarius*,) to which it is closely allied, by its narrow body, while the mandibles have several teeth, and the claws are armed with a large basal tooth. Mr. J. L. Russell, of Salem, has called my attention to its ravages on the leaves, buds and flowers of the raspberry, having been abundant for three or four summers past. It eats long strips in the leaves, but does the most injury to the fruit-buds. It was common June 18, when the sexes coupled. Hand picking proved to be the best remedy against its attacks.

INJURING THE OAK.

The many-toothed Priocycla.—This moth, which may be called the *Priocycla bilinearia*, and is not uncommon in the Northern States, though new to science, has been detected by Mr. W. Saunders, of London, Canada, feeding in the larva state on the oak. Unfortunately, the caterpillar was not described. It went into the chrysalis state on the 4th of July, and on the 17th, or thirteen days after, emerged as a moth.

In its adult form it is a fawn-colored moth, with deeply indented wings, the teeth being largest on the hind wings. The wings grow lighter towards their base. Near the outer third of the wing is a nearly straight brown line, with a single slight bend just above the median vein; beyond this line, the outer edge is darker, with a slightly sinuate diffuse broad band, obsolete in the middle, leaving a dusky patch near the apex and near the inner angle. On the apex is a broad, short, oblique, paler band. The fringe between the tips of the teeth is silvery, while the ends of the teeth are dark. On the hind wings are a few dusky scales near the outer edge, but not so distinct as on the fore wings.

The wings beneath are tawny yellow on the inner third of both wings, and dusted with brown scales; beyond, the wings are yellowish-brown, with the same markings as on the upper surface; but the brown, threadlike line on the hind wings is much more sinuate than above, and is double, inclosing a large, irregularly oval space. It expands 1.30 of an inch.

INJURING THE PINE.

The Pine Paraphia.—This moth, which is not very common, was raised by Mr. Saunders, of London, Canada, " from a brown

geometric larva on the pine, the imago appearing June 24." It undoubtedly is an inhabitant of this State, and may, like the other moths here enumerated, be ranked among the enemies of our pines. It seems to be undescribed, and may be called the *Paraphia piniata.*

It is of an uniform granite-gray or pepper-and-salt color, being whitish, mottled with dark gray scales, and is rather paler in the middle of the wings than on the outer edge. On the inner third of the wing is a curved, blackish band, becoming more distinct on the costa. There is an obscure small black discal dot, and just beyond it an obscure, diffuse, nearly straight line crosses the wing, becoming most prominent on the costa. Just beyond, and on the outer third of the wing, is a sinuate black line, slightly scalloped in places, and a little broader on the costal and inner edge of the wing. Just beyond its termination on the costa is a dusky costal spot, and just below, an irregular white spot, and another longer one near the inner angle. The outer edge of the wing is distinctly scalloped, the scallops being white, while the points between are dark brown. The hind wings are paler at base than on the outer edge, and are crossed by two black, nearly parallel lines situated near the middle of the wing; the inner is straight and broader than the outer one, which is more decidedly scalloped than on the fore wings; the outer edge of the wing is deeply scalloped, the middle tooth being considerably larger than the others. Beneath, the wings are uniformly pale gray, the lines being slightly reproduced, though the discal dots are much more prominent on both wings than above. The fringe is distinctly checkered with brown and gray.

The body of this specimen (which is a female,) is concolorous with the wings; along the abdomen are two rows of obscure, diffuse, dusky spots. It expands 1.38 of an inch.

The Pine Zerene.—To Mr. Saunders I am indebted for the information that this interesting moth, *Z. piniaria* n. sp., feeds on the pine. "The larva is a geometer, and is striped with red." It is a delicate white moth, with long fore wings, the outer edge being long and very oblique, and the wings are clear white, dusted with dark scales, especially along the outer edge. The fore wings are crossed by two zigzag rather broad and very prominent black lines, which touch each other just below the

middle of the wing. The inner line, situated on the inner third of the wing, has three large acute bends, and is broadest on the costa; the outer line is divided into six acute bends. There is a large round black discal dot. The fringe is white, black at the end of the venules. The hind wings are white and dusted with black scales near the outer edge, with the discal dot prominent; the outer waved line with acute scallops. The fringe is as in the fore wings. The head is yellow between the antennæ, and the front is square and white. Beneath much as above, but duller in hue. The wings expand 1.15 of an inch.

The pupa is rather thick, white, with a broad light brown band along the back, becoming widest in the middle of the body. There is also a narrow brown band along the side of the body, and on the under side of the abdomen are four longitudinal stripes of the same color. The wings are slashed with light brown and the antennæ and fore legs are concolorous, while the middle and hind legs are white. It is .44 of an inch in length.

The Pine Parennomos.—This rare and beautiful moth which is undescribed, and for which I would propose the name *Parennomos piniata*, has been raised by Mr. Saunders of London, Canada, from a larva found on the pine in the autumn of 1865, the moth appearing the next May on the 20th.

It is an ochreous brown moth, with unusually opaque wings, those of most of this beautiful family of moths (the Geometers, or Phalænidæ), being more or less transparent. The head, antennæ and thorax are pale ochreous, the antennæ of the male being furnished with short thick pectinations; the palpi are short, not passing beyond the front of the head, with the third joint short and minute. The fore wings are deep ochreous and paler at base; on the inner fourth is a white line forming a single large and acute angle on the median vein, along which it is prolonged beyond the basal third of the wing. There is a large irregular silvery white discal dot, and just beyond a broad silvery line diffuse on the outside; it curves inwards just below the median vein, and curves slightly inwards opposite the discal dot. Half-way between this line and the outer edge of the wing is a row of irregular white spots from which run whitish streaks to the fringe, which between the white spots is ochreous brown. These markings show through faintly on the under side. The hind wings are pale whitish ochreous above, beneath

washed with yellow ochreous upon and on each side of the venules. The costal area is yellowish. The legs are pale, concolorous with the upper side of the hind wings. The wings expand 1.35 of an inch.

It differs from any other native species of this family known to me by the peculiar opaque deep ochreous fore wings, and the large silvery discal dots and two silvery bands and slashes along the venules. It is also found in Massachusetts.

The moth belongs to an undescribed genus, for which I would propose the name Parennomos, in allusion to its resemblance in the shape of the head and its appendages to the well-known genus Ennomos. It will be more fully described in a forthcoming work on the Phalænidæ, the family of Geometers, to which it belongs.

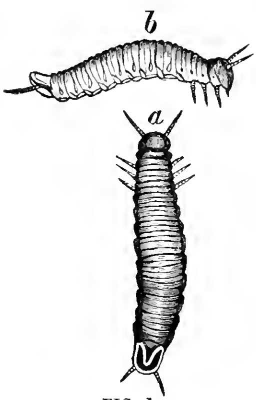


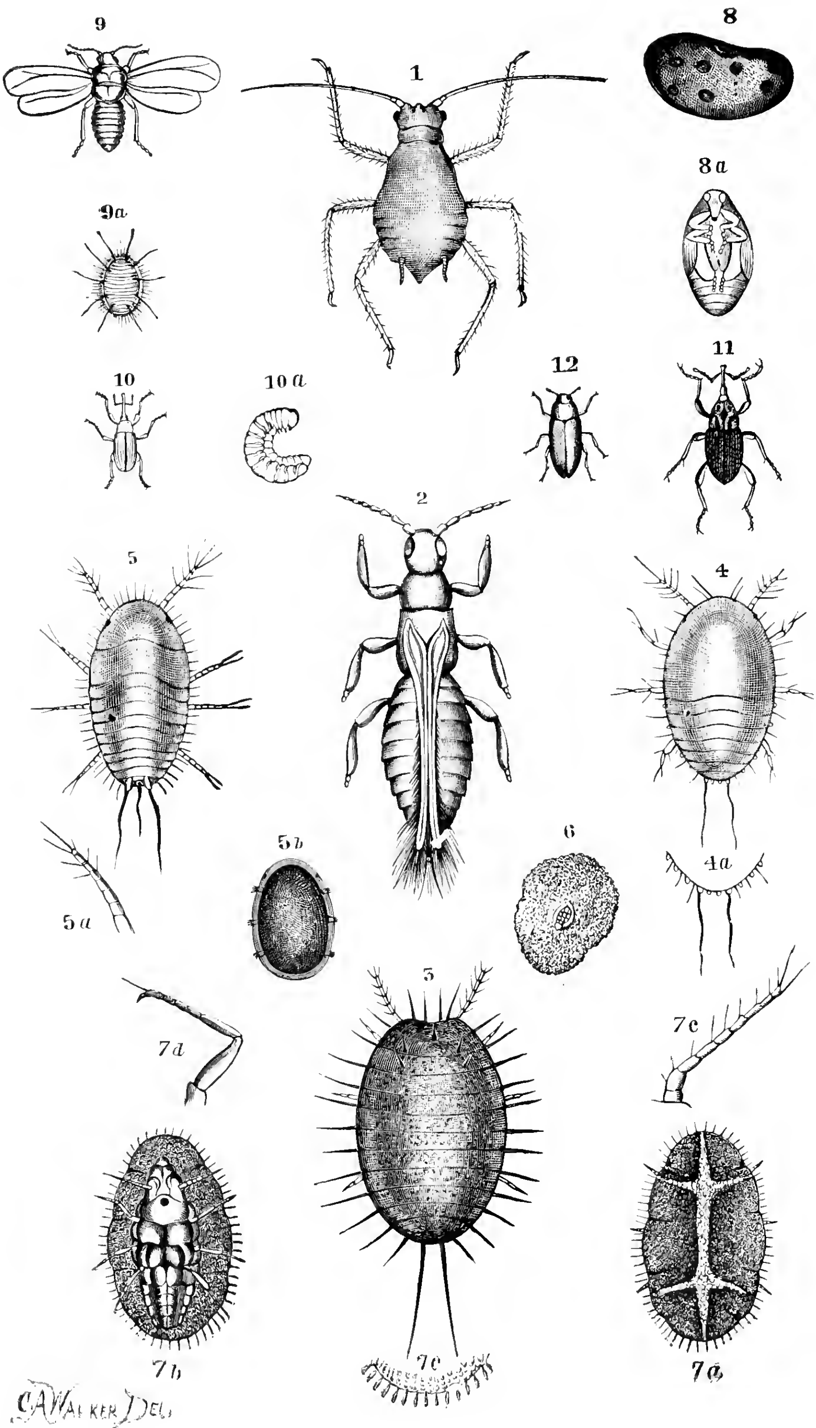
FIG. 1.

Saw-Fly larva on the Austrian Pine.—(Fig. 1, *a*, upper, and *b*, side view.) Late in September of the last year Dr. William Mack, of Salem, brought into the Museum of the Peabody Academy some singular false caterpillars which had assembled on a single branch of an Austrian pine, on his place, and had tied the needles together with a fine silken web filled with castings, forming a mass of castings, about six inches in diameter, with the needles of the pine among them, the leaves being separated by the larvæ from the branch.

This larva is a young Lyda, one of the saw-fly family, and while doing little injury to the tree so far as known, yet merits a short description. Dr. Ratzburg figures a similar species in his work on forest insects, and states that the *Lyda campestris* of Europe, to which our species seems closely allied, is sporadic in its attacks on the pine, and never proves very destructive.

The body is cylindrical, a little flattened and thickest in the middle, with small thoracic slender legs which are not used much in walking, the larva wriggling along when placed on a smooth surface. The head is pale reddish with a black spot between the antennæ; the prothorax is black above and the body reddish olive green, with a rather broad purplish line along the middle of the back. There are no abdominal legs, and the end of the

PLATE I.



body is somewhat flattened, with a black round spot on each side of the anal plate; beneath is a broad transverse incision. Below and arising from each side is a long, corneous, three-jointed, slender, outstretched appendage of the size and form of the antennæ. The under side of the body is mottled with greenish and reddish as above, with a reddish median line. On the side of the thorax are two rows of dots, and two rows along the middle on the ventral side of the three thoracic rings.

INSECTS AFFECTING ORNAMENTAL SHRUBS.

The Saw-Fly of the Tartarean Honeysuckle. Fig. 2.) One of our most beautiful ornamental shrubs, the Tartarean honeysuckle, is subject to the attacks of a false caterpillar, or saw-fly larva, which often completely strips the bushes of their leaves. These worms are the young of the *Abia caprifolii* of Norton, and they seem to be abundant throughout the New England States, extending west as far as Chicago.

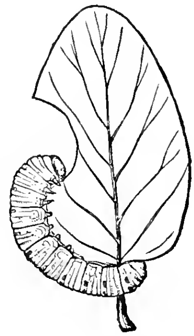


FIG. 2.

Early in June the female appears, and lays her eggs probably on the twigs of the shrub, as the recently hatched larvæ may be found eating small, circular holes in the leaves as soon as they are expanded. When fully grown, the larva (fig. 2, taken from the "Guide to the Study of Insects,") is of a peculiar pale bluish-green color, somewhat resembling the peculiar glaucous green hue of the leaf on which it feeds. Along the back, on the median line of the body, is a row of black, square spots, with a small, transverse yellow spot on each side. The body is transversely wrinkled, one wrinkle on each wing being the largest, and on this ridge the prominent black spot is situated; on the smaller wrinkles are smaller black and yellow spots, arranged on the side of the body in three irregular rows. Like the larva of Cimbex, to which it is closely allied, "it lies curled up on the leaf, and when disturbed emits drops of a watery fluid from the pores in the side of the body, and then falls to the ground." ("Guide," p. 216.) Our specimens spun their pale, yellowish silken cocoons, about one-half an inch long, in summer, but did not finish their transformations until the spring, the single male which I raised appearing late in May or

early in June. The body of the female is short and thick, and covered with dense hairs. The head is smaller than usual in the saw-fly family, being smaller than in Cimbex, its near ally, and is short and narrow. The palpi are white. The antennæ are club-shaped, 7-jointed, the terminal joint being bulbous, though less swollen than in Cimbex; the second joint is slender, considerably larger than the others, and somewhat flattened and angulated; they are blackish, reddish-brown at the tip of the terminal joint. The body is dark metallic olive green, and the wings are a little clouded, with pale, reddish veins, while the middle of the costa is a little darker. The second segment of the abdomen is yellowish-white, and the legs are white, the hind femora being dark beneath, while the terminal joints of all the tarsi are dusky, especially those of the fore legs, those of the hind pair being livid white. The under side of the abdomen is paler on the edge of the segments. The specimen described is from the collection of Mr. James Angus, of West Farms, N. Y. The body of the male, which has not been described, and of which we reared a single specimen, is rather slenderer and a little longer than that of the other sex, and it differs in having the second segment of the abdomen concolorous with the rest of the body, and the wings are more distinctly clouded. The abdomen is darker on the under side than in the female. The latter is .35 of an inch in length, and the male measures .40 of an inch.

The Lilac Botys.—A species of Ægeria, the *Æ. syringæ* of Harris, has been found by Mr. Angus to be quite destructive to the lilacs about New York. He has found numbers of the cast chrysalid skins projecting out of the limbs in which the borers lived. I have detected, in a portion of a branch sent by him, a new Botys, one of the snout moths. The moth appeared the 2d of June. Its larva had bored a passage about two inches in length through the pith, and spun a cocoon of fine pith-chips lined with silk on the inside. The long, slender, brown chrysalis lay in the middle of its burrow.

The moth, for which I would propose the name *Botys syringicola*, is peppery gray with bright yellow markings, while the under side of the wings is pale yellow. The head and body are pale gray, with a yellowish tinge, white on the under side of the body and under side of the palpi. The antennæ are pale

gray, like the body. The fore wings are gray, due to black scales lying on a pale straw yellow ground. On the inner fourth of the wing are two yellow spots, one just above, and the other just below, the median vein. In the middle of the wing, just below the costa, is a prominent square, bright straw yellow spot; on the outer fourth of the wing is a slightly curved yellow band, with three scallops on the outer edge, and extending to a large yellow patch in the middle of the wing, which is tridentate on the outer edge; it is bordered beyond with a black, zigzag line, and a fine, stout, yellowish line beyond. A dusky streak extends from the apex to the costal yellow band. There are two broken dusky lines at the base of the fringe on both wings. The hind wings are yellow, with four sharply zigzag dark gray lines. The under side of the fore wings is paler than above, with a yellowish tinge. The hind wings are pale yellow, with a single, much curved line on the outer third of the wing; and there are two dots near the middle of the wing, and a row of blackish dots at the base of the fringe. It expands one inch.

INSECTS INJURING GARDEN VEGETABLES, ETC.

The Bean Weevil.—(Pl. 1, fig. 8. Bean perforated by the larva; 8 *a*, the pupa seen from beneath.) This very destructive weevil seems to have been introduced from Europe, and has become established in the vicinity of New York, bidding fair to become a most formidable pest to our bean crop. Mr. Angus has been the first to detect its ravages, having found it to be already very destructive at West Farms, New York. Several years since he sent me specimens, and during the past autumn wrote me more particularly about its ravages, as follows:—"I also send you a sample of beans which I think will startle you if you have not seen such before. I discovered this beetle in the kidney or bush beans a few years ago, and they have been greatly on the increase every year since. I might say much on the gloomy prospect before us in the cultivation of this important garden and farm product if the work of this insect is not cut short by some means or other. The Pea Bruchus is bad enough, but this is worse."

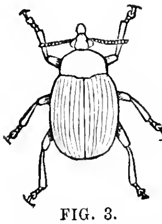


FIG. 3.

This insect is the *Bruchus granarius* of Linnæus, and has long been known in Europe to be injurious to stored beans. It closely resembles the Pea Weevil (*Bruchus pisi*, fig. 3,) of which an enlarged figure is introduced from our "Guide to the Study of Insects," as it presents the general outlines of the Bean Weevil. It is rather smaller than the Pea Weevil, measuring .15 of an inch in length, while the latter is .20 of an inch in length. Compared with that insect it is lighter and more uniform in color, being of a tawny gray, without the white spots so conspicuous in *B. pisi.* The uniform tawny gray elytra are spotted with a few oblong dark spots, situated between the striæ ; the antennæ also differ in having the four basal joints more reddish than in *B. pisi*, while the terminal joint is red, being blackish brown in *B. pisi.* The fore legs are much redder, and the two hind pairs are reddish where they are dark brown in *B. pisi.* The spine on the hind femora is smaller, but longer, and the antennæ are flatter, the joints being farther separated, and the whole body narrower than in *B. pisi.*

The pupa, (pl. 1, fig. 8 *a*,) is white, and measures .17 of an inch in length. The head is laid upon the breast, the red tip of the mandibles reaching to the base of the tarsi of the first pair of feet. The two front pair of legs are folded on the breast at right angles to the body ; the tarsi of the second pair reaching a little beyond the anterior third of the body, while the hind pair are concealed beneath the wings. The elytra are laid along the side of the body, directed obliquely downwards, and are marked with deep longitudinal ribs ; the under or hind pair of wings, which are much narrower than the elytra, project beyond the elytra, nearly meeting on the median line of the body. The eyes are dark and conspicuous, being red, horse-shoe like spots. The antennæ are laid upwards and backwards on the base of the elytra and behind the legs. The tip of the abdomen is smooth and unarmed. Length .17 of an inch.

The chrysalis lies in a cavity in the bean just large enough to receive its body, there being as many as eight or twelve in a single bean. (See pl. 1, fig. 8.) This cavity is indicated by a round, sometimes oval semi-transparent spot .08 of an inch in diameter; the insect escaping through a thin orbicular almost

transparent lid, previously gnawn by the larva, which falls off when the beetle emerges. The chrysalis is surrounded by a thin cocoon-like case, consisting of the castings of the larva, (which are long, cylindrical when highly magnified) closely packed together.

Though most of the pupæ had, November 25, changed to beetles, which had deserted the beans, many had not changed, and two or three out of the whole lot were in the semi-pupa state, the head and posterior part of the body being unchanged. By this we could determine that the larva closely resembled the larva of the true weevils in form. It is a short, thick, fleshy, cylindrical, footless white grub. The tip of its abdomen is rather blunt. Its head is rather small, white, with a pale yellowish clypeus, while the mandibles are flat, short and broad, and red in color. The rudimentary antennæ form a flattened round area on each side of the clypeus. The segments of the body are not convex, being rather flattened, but the sutures are slightly impressed. The body is a little flattened beneath, and very convex above, while the lateral, or pleural, region of the body is well marked. Length .16 ; thickness, .07 of an inch.

Curtis (Farm Insects, p. 361) states that this insect has been known in England to destroy half the pea and bean crop, often abounding at the end of May and sometimes continuing as late as August.

The best remedy against its attacks is to carefully examine the beans in the autumn and before sowing time, when their presence can be easily detected by the transparent spots made by the larva. These should be burned, and such beans as are apparently uninjured should be soaked for a minute in boiling hot water, so that no beetles be overlooked.

The Corn Sphenophorus.—(*S. zeæ* Walsh. Pl. 1, fig. 11.) In the Practical Entomologist (vol. ii. p. 117, 1867,) the late Mr. Walsh described this weevil, and gave an account of its ravages in the Middle and Western States. Mr. Robert Howell, in Tioga Co., New York, was among the first to detect it, and under date of June 14, 1869, he writes me that "this is the fourth year they have infested the newly planted corn in this vicinity. The enclosed specimens were taken on the 11th instant. I presume they have been in every hill of corn in my field. They pierce the young corn in numerous places, so that each blade has

from one to six or eight holes of the size of a pin, or larger, and I found a number last Friday about an inch under ground hanging to young stalks with much tenacity. When very numerous every stalk is killed. Some fields two or three years ago were wholly destroyed by this insect."

It is a rather large black weevil, with a long narrow sub-cylindrical body, and with coarse gray punctures. The head is black, finely punctured, with still more minute punctures on the beak. At the base of the beak just between the eyes is a small oval pit. The beak is nearly one-third as long as the body; it is curved downward, slightly compressed, with the tip seen from above dilated slightly, and triangular. On the prothorax is a long lozenge-shaped smooth black median area, with two smooth spots on the side near the front; these with two longer diverging spots behind form an inverted Y on each side of the body. Behind are coarse gray punctures. The wing covers are marked with rows of coarse punctures along the striæ much larger than those of the thorax. On the smooth spaces between the striæ is a row of more or less crowded minute punctures. On the base of the elytra near the outer edge is a low smooth tubercle, and a larger one near the tip. On the extreme tip of the abdomen beyond the elytra are two short diverging rows of fine stiff tawny hairs, which stand out straight from the end. The legs are black, the tarsi reddish piceous. Beneath, the body is black and thickly punctured. It measures .40 of an inch in length.

Until we know more of its habits, its mode of life in the larva stage, and its native food-plant, we are at a loss to suggest remedies against the attacks of this insect. When the corn is observed to be suffering from their punctures, they should be picked off with the hand, and the young blades of corn carefully watched. These weevils are so large as to be readily detected after a little practice. I have detected this insect at Hyannis, Mass., June 25; hence farmers in this State should be on the watch for this formidable insect-pest.

Habits of an Asilus Fly.—During the preceding summer, Messrs. F. W. Putnam and C. Cooke discovered the burrows of *Proctacanthus Philadelphicus*, our largest species of robber-fly. These flies, in the adult or winged state, prey on other insects, and while usually beneficial, are sometimes, as in the case of the "bee-killer," *Trypanea apivora*, described by Dr. Fitch,

is guilty of seizing and devouring honey-bees. The larvæ had made their burrows in the loose and shifting beach sand by the seashore, in which grew scattered blades of a grass on the roots of which the larvæ probably fed. The insects had all passed, at the date they were observed, (July 18th,) either into the pupa state, or were flying about the beach, having undergone their transformations. The chrysalids (fig. 4, front and side view,) were observed protruding about an eighth of an inch from the edge of the hole.

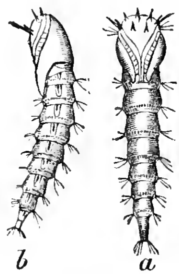


FIG. 4.

The head and thorax are gathered into a mass very distinct from the abdomen, which is unusually slender, cylindric and rather long. The head is short and small, and considerably narrower than the thorax. On the vertex are two large curved spines, and on each side below is a large oblique tubercle, like a deer's horn, and giving rise to three stout spines like those on the vertex. Below, and on each side of the front, is a little pit. The mouth-parts are well developed, the labrum being square and nearly one-half as long as the mandibles, which are large and reach nearly to the end of the labrum, which is broad and rounded at the end. The legs are convex and not so much merged in with the integument as usual; the second pair are partially overlapped by the wings, the ends of the third pair projecting beyond the rather small wing-cases. The whole mass of appendages is raised from the base of the abdomen, and reaches to the front edge of the third abdominal segment. On the side, near the base of the legs, is a tubercle, giving rise to two spines of unequal length. Just above, and placed a little anteriorly, is the large, round prothoracic spiracle. There are seven pairs of abdominal spiracles. The abdomen is long, cylindrical, a little curved, gradually tapering to the blunt tip; the segments are rather convex, and the sutures wide and deeply cut; along the side is a large convex ridge on which the spiracles are situated. Near the hind edge of each segment is a row of long, stout spines, of unequal length, surrounding the body, many of them being one-half as long as the segment itself. At the base of the terminal joint is an impressed triangular area, and at the tip two rather long, straight spines arising from slender tubercles; beneath, are two pairs of small tuber-

cles, those at the extreme tip being the smallest and placed nearest together. It is 1.15 of an inch in length.

Habits of the Horse-Fly.—Common as the horse-fly is in summer, little is known of the early stages of the numerous species swarming in our marshes and over our roads. Westwood remarks that "we are indebted to DeGeer for the knowledge we possess of the transformations of this family. The larva of *Tabanus bovinus* DeGeer is found in the earth, and is an elongated, sub-cylindric form, attenuated at each end, especially in front; it is destitute of feet, 12-jointed, having the head distinct, narrow, elongated, horny, armed with two strong hooks, antennæ and palpi; the fourth to the tenth segments have an elevated dorsal papillose ridge used in progression; the terminal segment is minute and tuberculiform." Mr. B. D. Walsh has found in Illinois the larva of a species of this genus which is aquatic, living under submerged objects. It is a greenish, transparent worm, cylindrical, 12-jointed, the body being most slender towards the head, which is small, truncate, conical, the anterior part capable of extension, with short, fleshy antennæ. There are six pairs of dorsal, fleshy tubercles. On the under side of the abdominal segments are six retractile false legs, and a single and retractile proleg. It is, when disturbed, vigorous and restless, swimming quickly, often elevating the anal slit, in which the stigmata are probably placed, out of the water to take in the air.

For the knowledge of another species, the *Tabanus atratus* Fabr., I am indebted to Mr. James Angus, of West Farms, N. Y., who found a pupa in garden soil, and reared the fly from it. This chrysalis (fig. 5,) is 1.40 of an inch in length, and .30 of an inch in thickness. It is long, cylindrical, and rather slender, and the thorax is no thicker than the abdomen. The head is nearly two-thirds as long as the thorax, and is large, cylindrical, truncated in front, the end being convex, while the whole surface of the head is smooth and shining. In the middle of the convex end are two thick, flattened tubercles; just below, is a transverse curved ridge, divided into two portions by the median line of the body; on each side of this ridge is a low, flattened tubercle. On top of the head, near the anterior end, is a pair of minute tubercles.

FIG. 5.

The thorax is cylindrical and very long, being nearly half as long as the abdomen, and very smooth. On the prothoracic segment is a large, long, narrow, curved spiracle, while the abdominal spiracles, seven on each side of the body, are round and raised on a low tubercle.

The abdomen is long, cylindrical; the segments are not convex, and the sutures between them are well defined. On the posterior edge of each segment is a row of stiff hairs surrounding the body; they are not so stiff and spinelike as in the Asilidæ. On the tip, which is rather blunt, are six short, stout spines. The legs and wings are soldered to the body more closely than in the pupæ of the Asilidæ, and are merged with the integument. When the fly emerges from the chrysalis, the thorax splits open along the back, the front of the head separates, falls forwards, and the fly crawls out of the rent thus formed.

This species is larger than most of the species of Tabanus, and seems to differ generically from them in the conical head, the large eyes, while the mouth-parts are constructed more like those of the common house-fly, the bladelike jaws and labrum not being well developed, so that it is doubtful whether this species bites like the well-known "green-head" horse-fly and its allies. This species is nearly an inch in length, and is black throughout, including the mouth-parts, legs, antennæ and wings.

PLANT-HOUSE INSECTS.

By far the most injurious insect in our plant-houses is the Aphis, of which I have noticed two species which have probably been imported from Europe. One is entirely green, with a broad, flattened abdomen. The wingless, asexual form, is figured on Pl. 1, fig. 1. I have not yet been able to identify the species. The other is spotted with black on the abdomen, and is abundant on various hot-house plants. The best means to get rid of them is to smoke the plants with tobacco, or wash them with soap-suds, and turn a stream on them from a hose.

The White Scale Bark-Louse.—The most troublesome bark-louse in the Amherst and Cambridge plant-houses is the *Aspidiotus bromeliæ* of Bouché. (Pl. 1, fig. 6, magnified; 4, young, magnified; 4*a*, end of body still more enlarged.) It infests the long, narrow leaves of the acacia, the small, white scales crowding upon one another, especially along the mid rib, scarcely a

leaf being free from them. To the naked eye these bark-lice appear like scales of wax, and they are in most cases easily removed from the leaves by washing them with strong soap-suds, and removing them with the finger-nail.

When magnified, the scale (Pl. 1, fig. 6,) is snow-white, lenticular, orbicular, being no longer than broad. The dead and shrivelled body of the female is in the centre, and in form is ovate, with a median dorsal slight ridge, the width of the body being equal to that of the margin itself. It is of a yellowish color, contrasting with the snow-white thin edge of the scale, the surface of which is minutely granulated, as if frosted over.

The young, which have not, to our knowledge, been described, differ from those of *Lecanium platycerii* in being more convex; the body being thicker, with the hinder edge regularly oval, and the edge of the body, especially posteriorly, thicker than in the before-mentioned species. The hind edge is not sinuated and tuberculated, as in *L. platycerii*, but rather agrees with Riley's figure of the young of *Aspidiotus conchiformis*, also figured in the "Guide," p. 529, and this is probably a character of generic value. The body is also less convex along the middle, and the segments are less distinctly marked than in *L. platycerii*, while it also differs in having around the edge of the posterior third of the body a series of minute tubercles, (fig. 4, *a*,) alternating with the fine hairs fringing the edge. The 8-jointed antennæ end in three hairs, and the eyes are black and prominent.

It also occurred very abundantly on the leaves of the *Olea fragrans* during the month of November, specimens having been sent me by Mr. Charles Wright, of the Cambridge Botanical Garden, where both the young and old occurred.

Some of the scales had a single large hole in them, made by a minute ichneumon fly of the Chalcid family. One specimen was observed walking over the surface of a leaf, but unfortunately, owing to its minute size, was lost before a description or drawing could be made of it. It was pale whitish yellow and blackish in color, with a short, thick, rather broad body and a rather large head. It must destroy a considerable number of the bark-lice, as several scales were perforated by them. It may prove to be a species of Coccophagus, a genus allied to Encyrtus, and known in Europe, according to Westwood, to prey on bark-lice.

It was also abundant on the leaves of *Guidia simplex* and of the ivy, which were white with their scales, while the young were also common in December.

The Orange Bark Louse.—Mr. James Angus has called my attention to a species of Aspidiotus, which is very troublesome in hot-houses about New-York, infesting the leaves of the orange and lemon. He writes me that "during the course of a season, if let alone, they will multiply so as to entirely cover the stem, branches, leaves and fruit, and indeed every part of the tree. I have to scrub every limb, leaf and fruit twice a year, or we would not have a tree worth looking at. I have found them so abundant at the end of the summer that it was folly to attempt to clean the leaves and branches; hence I was obliged to cut back all the branches to the trunk, (which is more easily managed than the leaves,) and bring them into new wood." I have also found the same insect on the skin of oranges imported into Salem, probably from the Mediterranean or the Azores, and am inclined to consider it identical with my *Aspidiotus Gloverii*, mentioned and figured on page 527 of the "Guide to the Study of Insects." Unfortunately, we have not been able to obtain either the male or female. The scales on the leaves received from Mr. Angus were in most cases remarkably long and linear, straight or curved, some specimens being .20 of an inch in length and only .02 in breadth, while many were wider and shorter, as represented in our figure, 6*d* (copied into the "Guide" from Mr. Glover's drawings of individuals observed by him in Florida). They are of a pale reddish color, smooth and shining, with a yellowish oval scale at the pointed end, with a raised median ridge, and smaller transverse ridges. Some scales are much shorter and broader, and resembling the *A. conchiformis* of our apple-trees; such I have found on the skin of imported oranges. Fig. 6*a*, represents the male; *b*, the female; *d*, a linear scale enlarged; while *c* represents the female of another species, also found on the orange.

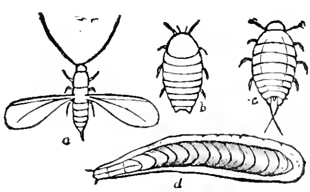


FIG. 6.

The Fern-Bark Louse.—Another species, found in inconsiderable numbers on various ferns of the genus Pteris, etc., seems to be identical with the Lecanium of the ferns, the *L.*

filicum of Boisduval. (Pl. 1, fig. 7*a*, scale enlarged, seen from above; 7*b*, the same, seen from beneath, and showing the form of the body surrounded by the broad, flat edge of the scale; 7*c*, an antenna, enlarged; 7*d*, a leg, enlarged; 7*e*, end of the body, showing the flattened hairs fringing the edge.) It is regularly oval elliptical, both ends of the body being alike, though the anterior end is a little narrower than the opposite, and is much flattened. Along the middle of the body runs a prominent ridge, considerably thickened in the middle, with a similar transverse ridge just behind the anterior third of the body, and another one on the posterior third of the body. On the edge of many specimens are fine ridges, eight on each side, which radiate outwards to the edge, which is fringed with minute hairs and is very thin and broad. It is of a roseate tint, pale around the edge of the body, and with a darker patch in the angles between the median and transverse ridges. On the under side it is flesh-colored, with traces of the minute dorsal ridges appearing beneath. The antennæ and legs are very slender, the former reaching one-fourth and the legs one-third of their length beyond the edge. The anterior legs are inserted twice as far from the second pair as the second pair from the third. Length of a mature female, .09; width, .06 of an inch. It moves very slowly over the surface of the leaf. Boisduval's description is so short as to be scarcely available in determining this species, but as far as it goes it agrees with our insect.

The Platycerium Bark Louse.—Another of this genus was found on the leaves of the *Platycerium alcicorne* in the plant-house. It may be called *Lecanium platycerii.* In form it is regularly oval, flattened and slightly convex above, with a slight ridge along the middle of the body. In dry specimens, especially the smaller ones, there are minute ridges radiating from the middle to the outer edge. The body of an adult female, (Pl. 1, fig. 5*b*,) after it has ceased moving about, and has apparently laid its eggs, as several young were found hiding under the body, is entirely flat beneath, being neither concave nor convex, finely granulated, and pale brown above. The antennæ are obsolete, and the region of the mouth dark and discolored, the mouth-parts having probably been torn away and remaining in the substance of the leaf. The body, in the younger stages of this genus, quite distinct from the expanded edge, was in this spec-

imen merged with the edge; the feet were very slender and threadlike. Its length was .15, and its width .10 of an inch.

The young (Pl. 1, fig. 5, magnified; *5a*, an antenna, enlarged,) were discovered about the 15th of November, moving over the surface of the leaves, or hiding under the bodies of the females or the lifeless scales. They are thin and flat, scalelike, and of a light reddish-brown color. The median region of the body is raised, and on the large, broad head are two prominent eyes. The prothoracic (or second segment from the head,) is three times as long as the succeeding one. There are eight abdominal segments; from the terminal one arise two long filaments, being one-half as long as the body is wide, springing from two rather large tubercles, with a deep sinus between. Situated between these two tubercles is a circular, flattened tubercle, from which arises a short, hairlike filament one-half as long as the others. The antennæ are 8-jointed, the terminal joint giving rise to three large hairs. The legs are rather long, equalling the antennæ in length, and also of about the same length as the anal filaments.

The Plant-House Coccus.—(Pl. 1, fig. 3, magnified.) This well-known pest is often called the "mealy bug." In form it closely resembles the young of Aspidiotus and Lecanium, but measures a tenth of an inch in length; and reasoning from this fact, it is evidently lower in the scale than either of those two genera. It was described by Linnæus under the name of *Coccus adonidum*, and has been introduced from Europe into our plant-houses, where it is a great pest. The body is long, ovate, consisting of fourteen well-marked segments, counting the head as one; the sutures are very distinct, especially on the sides. It is covered with a mealy substance, white and cottony, with long, cottony filaments on the edge of the body, the two terminal ones being often half as long as the body, and sometimes still longer. The young are not so wide as the adults, the latter becoming broader and flatter with age. When about to lay its eggs, it adheres by the long, slender beak to the surface of the leaf, and secretes from the abdomen a large, cottony mass, which surrounds and partially covers the end of the body, and encloses the pale orange oval eggs.

It is found to be especially injurious to the camellia, hiding about the buds, to the azalia, oranges, lemons and similar plants.

The best method of removing all the bark-lice, as well as the Thrips, is to wash the plants thoroughly with strong soap-suds, and give them frequent showerings with the hose.

The Plant-house Aleurodes.—(Pl. 1, fig. 9, enlarged; fig. 9*a*, pupa, enlarged.) Mr. J. L. Russell has found this insect, which belongs to the same family as the Coccus, in great abundance on the tomato in his garden in Salem, and also on some of his house-plants, especially *Salvia splendens*. I have also found it on fuschias in February and March in all its stages. In this genus the females are winged as well as the males, and the two sexes are much alike; the antennæ are 6-jointed, with the second joint lengthened, and in the fore wings, which are broad and covered with a fine white powder, there is but a single vein.

The young, or larvæ, of the present species, which seems to be the *Aleurodes vaporarium* Westwood, so called from living in hot-houses, is somewhat like the young of the two other genera of bark-lice mentioned above, being broad, oval, thick, with the middle of the body raised longitudinally; the segments are distinct, and there are two very short anal hairs. The abdomen is wrinkled transversely, the head and thoracic segments being smooth. They are .03 of an inch long. The pupa is convex, rather thick, oval, elliptical, with a fringe of hairlike filaments around the edge of the body, from the top of which arise from six to nine long hairlike filaments, secreted, as Signoret states, from the surface of the body on each side, projecting straight up; two of which arise from the head. It is yellowish-green, and .03 of an inch long. Just before the imago emerges, the head and thorax of the pupa are very convex, and much higher than the abdomen, and the eyes of the adult are very prominent.

The adults have pale, yellow bodies and pure white, unspotted, powdery wings, with dark-red eyes; the beak is very long and dusky at tip, and reaches beyond the base of the thorax. The second joint of the antennæ is twice as long as the basal one, and is nearly globular; the median vein of the fore wing is forked just beyond the middle of the wing.

Early in September they were so abundant on the tomato as to rise in clouds like snow-flakes from the leaves, on being disturbed, according to Mr. Russell.

This genus seems allied to the Psyllidæ, in the females being

winged like the males, and other structural characters. Next above stands Coccus, which resembles, in the adult stage of the female, the young of Lecanium and Aspidiotus. The genus Lecanium differs, besides other structural characters in the females remaining very minute, and secreting a scalelike covering, or cocoon, which, as in *A. conchiformis* or *A. Gloverii*, is long and narrow, with the dead skin of the female at the smaller end, or surrounded by it wholly, as in *A. bromeliæ*. In Lecanium, however, the female grows to a large size before laying her eggs, which are not protected by a scale, but by a cottony secretion. I have found the young of *L. platycerii* hiding under the body of their parent, which was still living, moving its antennæ and legs. The Aspidiotus should therefore be considered, perhaps, as a step higher than Lecanium in the zoölogical scale.

The Hot-House Thrips.—(Pl. 1, fig. 2, magnified.) This is one of the greatest pests in our hot-houses. It is the *Heliothrips hæmorrhoidalis* of Burmeister, and agrees perfectly with the descriptions of the European insect. In all its stages it may be found puncturing the leaves of liliaceous plants, azalia, Pellea hastata, aspidium, pinks, &c., &c., and by its attacks causing the surface of the leaf to turn red or white in blotches, or sometimes the whole leaf withers and whitens. The larva and pupa are white, long, with short antennæ. After several successive changes, it assumes the adult state, and the pupæ may be found in different stages of growth, with the antennæ turned underneath the head, and the rudimentary wings folded to the sides of the body. The eyes are pink. The half-grown young are shorter and broader than those fully mature. Haliday describes the adult in the following words: "Dusky black, the extremity of the abdomen ferruginous. Antennæ and legs white, the base and sixth joint of the former dusky, wings almost hyaline. The body above is entirely netted with elevated lines, forming pretty regular hexagons, equal in size on the head, where they are largest, to those of the eyes, and disposed in perfect rows on the abdomen." It is about one-twelfth of an inch in length.

The best remedy against them is repeated washings with soapsuds, cleaning each leaf by itself.

PEABODY ACADEMY OF SCIENCE,
SALEM, February 10, 1870.

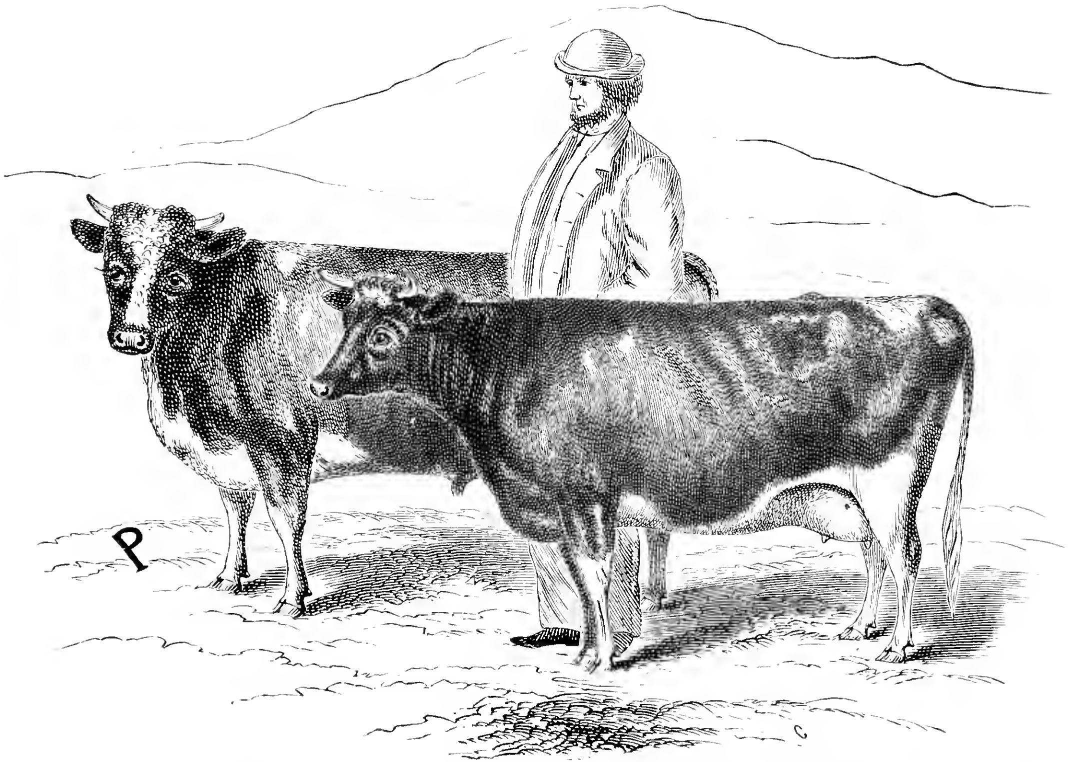
I am happy to report that the agricultural societies are, for the most part, in a strong and healthful condition. But there is a wide difference to be found among them in respect to their efficiency and power for good, owing chiefly to the management adopted by them. Some of them comply with the spirit of the law, and aim to gain and to diffuse information, to awaken enterprise, emulation and mental activity; while others content themselves with a bare compliance with the letter, and add nothing to our present stock of knowledge, and nothing to the general intelligence of the State. The former publish valuable reports, full of instruction and replete with information and interest, and regard this as the great leading object of their existence; while the latter spend their energies altogether upon the fair,—which, though in itself educating, is ephemeral in its influence, and, at best, only of secondary importance,—and return little or nothing for the money they receive from the State, nothing of general value, nothing on which the mind can dwell with any degree of satisfaction.

Now the main object of the State in awarding bounties is not to distribute its money to please a few small contributors, but to develop its material resources by adding to the general intelligence upon farming; to encourage experiment and farm improvement; to increase the quality and value of our stock by holding up a high standard of excellence; and, above all, to elevate the dignity and character of agriculture itself as a practical pursuit. The State expects, and has a right to expect, that every society will comply with the spirit as well as the letter of the law, by contributing its proportion to the general intelligence.

CHARLES L. FLINT,

Secretary of the State Board of Agriculture.

BOSTON, January 26, 1870.



BRITTANY COW "EMPRESS," AND BULL "NAPOLEON."—OWNED BY WILLIAM KNOWLTON, OF UPTON,

See Preface to Abstract.

APPENDIX.

REPORTS OF DELEGATES

APPOINTED TO VISIT THE

AGRICULTURAL EXHIBITIONS.

ESSEX.

The Fifty-Second Annual Exhibition of the Essex Agricultural Society was held in the city of Newburyport, on the 28th and 29th days of September. The weather was most propitious, especially the second or great day of the show—one of those brilliant autumnal days when Nature seems to put on her golden robes, as it were, to grace the farmer's holiday. The exhibition was largely attended, and was worthy of the well-earned reputation of the Society and the intelligent cultivators of Essex soil. This county has but one agricultural society, and has always itinerated in holding its shows, rotating from year to year through the cities and populous towns, thus bringing the exhibitions to all parts of the county.

Without discussing the comparative benefits of this course, so long and successfully continued by the Essex Society, it is proper to present for our consideration the advantages which are claimed by the friends of this measure; and *first*, it is believed that the holding of the exhibitions in different parts of the county excites new enterprise and emulation in these districts, furnishes a better method for the diffusion of industrial art and improved husbandry, and gives to the Society many new members from the neighborhood where the shows are held. *Secondly*, the saving of large investments in grounds, buildings and fences, which are generally unproductive, except at the time of the exhibition.

The Essex Society, having no permanent grounds, has no horse track, and has always discountenanced horse racing as creating an overshadowing influence and excitement, both of which are considered by a majority of the members of the Society as prejudicial to its best interests, and not legitimately connected with a cattle show.

To compensate for the excitement of the horse track, this Society has endeavored to make the ploughing match one of the great points of attraction, and in this department it probably surpasses most other societies in the State. The special attention bestowed on ploughing has done much, it is affirmed, to raise the standard of good work, as well with oxen as with horses. One of the most interesting parts of this exhibition in ploughing was the performance by boys, to whom special premiums are awarded, thus training them up in the way they should go, so that when they are old they may not depart from the good custom of their fathers.

The Ploughing Match.

This was held on a beautiful spot, in full view of the ocean. The land was of a sandy loam, free from stones, and very suitable for good ploughing. There were eighteen entries, including those of the boys, which, as usual, attracted great attention. The judges were very assiduous in examination, and the work was handsomely done—some of it scarcely to be surpassed.

The Stock.

The stock on exhibition was not so numerous as on some former exhibitions, but it contained fine specimens of most of the approved breeds. There were, however, over two hundred animals, and among these the milk-white herd of Shorthorns from Major Ben Perley Poore, of Indian Hill Farm, West Newbury, giving proof of the maxim, that in breeding with care "you can breed out the last black feather from the pigeon's wing." The exhibition in the Horticultural Hall was especially fine. There were over 350 plates of pears, 230 of apples, and nearly 200 of grapes, and it is no detraction to state that in the department of apples and grapes, it rivalled the Boston exhibition of 1869.

There were 20 pairs of oxen and steers, 30 swine, 32 sheep, and 20 entries of poultry; 76 entries of vegetables, 140 of flowers, 33 of bread, 280 of manufactures and fancy articles, 10 of butter and cheese, 8 of agricultural implements, 10 of carriages and wagons.

The vegetable section was superior, and comprised wonderful specimens, which, as usual, are expected from a county so celebrated for its squashes, onions and other vegetable products. Among these were fine samples of the new seedling potatoes, among which the Early Rose took a prominent stand. The liberal show of flowers, embracing many of the novelties of the day, added beauty and brilliancy to the exhibition.

The result of the competition in the various departments was the award of twenty-seven diplomas, and over one thousand dollars in money.

The Address.

After the ploughing match had been concluded, the procession was re-formed and proceeded to the Pleasant Street Church, whereupon other appropriate services were performed, the address was delivered by Mr. Benjamin P. Ware, a farmer of Marblehead. He spoke of the methods by which farming might be made profitable; the improvement of our products; the increase of crops per acre; the importance of fruit growing, especially the apple; the necessity of agricultural education; the success of our agricultural colleges as no longer an experiment; and many other topics, which evinced a thorough knowledge, not only of tilling the soil, but the tilling of the mind. As the address is already before the public, I will not further enlarge on its excellence.

The Dinner.

This was provided under a spacious pavilion, to which about five hundred ladies and gentlemen sat down. The president of the society, General William Sutton, presided. After the repast, speeches were made by the president, Hon. Allen W. Dodge, ex-president, Major Ben Perley Poore, Mr. Ware, orator of the day, Rev. Mr. Spaulding, Dr. Kelley and others. Your delegate was also called on to respond in behalf of the State Board. He alluded to the stability and influence of the Essex Society from the days of Timothy Pickering, its first president, to the present time; also to the excellence of the fruits on exhibition, tracing this improvement back to Robert Manning, an Essex man, and one of the founders of the Massachusetts Horticultural Society; and still further back, to Governor Endicott, whose pear-tree still survives at Danvers. These and similar examples were the seed, which has vegetated, and to which may be traced, in a great measure, the increase of agricultural and horticultural societies in our country, which he estimated at more than thirteen hundred at this time. He alluded also to the efficient labors of the gentlemen whom he saw around him,—to General Sutton as a liberal benefactor, Hon. Allen W. Dodge, ex-president and secretary for many years, and to Major Ben Perley Poore, who for a long time was his secretary in the United States Agricultural Society, the orator, Mr. Ware, and to others as associates and co-laborers in the promotion of agricultural and horticultural knowledge.

Your delegate expressed the great satisfaction he had experienced, after an absence of twenty years, in being present on this occasion; also in the prosperity and usefulness of the Essex society, in the courtesies extended by the president and secretary, and especially the attentions of the noble band of young men who acted as marshals on the occasion, the young men who in former days were denominated by Mr. Everett as the "Flower of Essex," the young men who in all coming years were to be the bone and sinew of society, and exhorted them to let their light so shine that others, seeing their noble example, might follow it.

In conclusion, your delegate would state that the Essex Society still preserves its lead as one of the best-managed and influential societies in the State. The example of its first president (who was also the first secretary of the first agricultural society established in our country) is still felt, and has been handed down through long terms of official service to the present day. Colonel Pickering was president ten years, John W. Proctor secretary twenty years, and president five years, Allen W. Dodge secretary seventeen years and president three years, William Sutton, treasurer twenty-five years and president three years, C. P. Preston secretary ten years, and now holds the office. Others have held office for shorter terms, but the policy of the Society seems to have been, not to make frequent changes, but to preserve as long as possible the services of her faithful incumbents; and it may be stated also that its orator has always been selected from within the limits of the county, and this has been considered as one of the greatest honors that the Society can bestow on its members. In confirmation of the practice of retaining long in office her best working men, we have an illustration in the fact that the Society has sent to this Board as her representative for the last ten years our able and popular associate, Dr. George B. Loring.

MARSHALL P. WILDER.

MIDDLESEX.

The exhibition of the Middlesex Agricultural Society was held at Concord, on the grounds of the Society, October 7th and 8th. The occasion was one of peculiar interest, being the seventy-fifth anniversary of the establishment of the society, and being the first occupation of the ample hall and improvements, which have been erected within the last year.

It is well known that for many years Concord has been the centre of great agricultural enterprise and success. From the earliest day the subject of agricultural education and investigation has occupied the minds of the leading citizens there, and encouragement has always been extended by them to the various improvements which have from time to time been made in the various branches of farming in our State. It is evident that the Middlesex Society is determined to keep pace with the agricultural progress of the time, and to be faithful to the example set by its early founders. The recent purchase of new and well located grounds, and the erection of a spacious hall, gave unusual opportunities to this exhibition. The grounds, as yet not fully enclosed, are provided with comfortable covered sheds for cattle, and are arranged with an unusually good understanding of the wants of exhibitors; and the hall, which is 130 feet long and 70 feet wide, two stories high, with a light and convenient basement under the whole, and furnished throughout with tables, show-cases, crockery, kitchen arrangements, a good supply of cold water in all parts of the building, and all other necessary fixtures, is a model for such structures. It is not too much to say that the liberality of those citizens of Middlesex who have contributed to the outfit of this Society is entitled to the gratitude of the agricultural community.

The collection of animals and articles for exhibition, as witnessed by your delegate, was highly creditable and attractive. The specimens of Ayrshires and Jerseys on the ground were of high quality, and indicated care in selection, and judgment in breeding. The number of animals was large enough for all practical purposes, and the most critical advocate of either of these breeds could have found model animals for examination. It is evident that the soil and climate of Middlesex County are well adapted to animals of medium size—the Ayrshire, which has been bred there ever since the days of Mr. Phinney, and the Jersey, which was accepted early by gentlemen of agricultural taste and wealth there, having manifestly improved since their introduction. The attempt to introduce larger cattle, requiring luxuriant pastures and heavy winter feed, is yet in its infancy, and, while admirable animals of various large breeds are found there, the result of their use is yet undetermined. The herds of cattle entered for premium were of hardy constitution, medium size and good shape, and indicated good care and selection on the part of the owners, who are devoted to the business of the dairy.

The exhibition of swine was excellent, the large and thrifty breeds predominating. The Yorkshire was well represented, as

was also the Chester County. The production of a large, long, solid, well balanced hog, with two good ends and a well developed middle, is evidently the desire of the farmers of this Society; and they have succeeded well in their work.

The display of poultry was very attractive. More than one hundred coops were arranged for examination, and they contained almost every well known and desirable variety. It was evident that the profits of poultry were well understood by the exhibitors at this exhibition; and it is to be hoped that the Society will offer liberal premiums for reports upon the best experiments in poultry breeding and feeding, and will provide for comparisons among the various breeds.

Among the horses were many fine animals, indicating a continued interest in this subject, which has attracted so much attention in this section of the State.

A large and valuable collection of agricultural implements attracted universal notice; and there can be no doubt that this Society will one day institute a trial of implements in the field—occupying, as it does, a central point of large agricultural enterprise.

It would be unjust to this exhibition were the specimens of crops presented in the hall to be passed by unnoticed. It is seldom that such a collection is witnessed. Not only in size, but in quality, were the vegetables worthy of admiration. No inferior cultivation, no misapplication of manure, no badly selected fertilizers, ever produced such crops. And while the display of garden vegetables indicated great skill in their cultivation, the field root crops had evidently received their share of attention from the enterprising farmers of this county. In close proximity to these fine vegetable crops were to be found those fruits for which Concord and the vicinity have become so famous. The grape has found its headquarters there, and, judging from the specimens on exhibition, it is evident that the practices adopted in the orchards and vineyards of Concord are worthy of all imitation. It is understood by your delegate that Mr. John B. Moore, of Concord, has contributed a valuable statement of his modes of cultivating the grape, and it is hoped that it will be incorporated into the Transactions of this Board.

The annual dinner of this Society was held in the hall, and was an interesting part of the ceremonies of the exhibition. And it is due to the president of the Society, John Cummings, Esq., to commend his wise and practical suggestions as presiding officer of the occasion. There were many valuable suggestions made at those tables, both by His Excellency Governor Claflin and by the gentle-

men associated with him, but no man said a better word than Mr. Cummings uttered when he urged the value of the best intelligence in farming, and said, "it is to no one so important as to the practical farmer to know the laws that govern the vegetable kingdom. The blight upon his crops is no longer a curse sent from God to punish him, but some parasite fungi, caused, it may be, by his own neglect."

It is evident that the theory and practice of the Middlesex Society make a valuable contribution to our agricultural literature.

Geo. B. Loring.

MIDDLESEX NORTH.

As delegate from this Board, I visited Lowell, September 30th, under mistaken ideas that this was the first day of the "Fifteenth Annual Exhibition of the Middlesex North Agricultural Society," but to my regret I found the Exhibition was the 29th and 30th, instead of the 30th and 1st October. Arriving as I did at a trifle past meridian, a hurried view was necessarily taken of the show and surroundings. I found the attendance almost wholly farmers and their friends, and I might say these are the life and sinew of our agricultural societies, and where they lend a hearty coöperation, a healthy and prosperous future is sure. I think it my duty to here say there was cause for a non-attendance of the citizens in general, viz., the fire companies of the city making this their holiday or muster. The weather was all that could be asked for,—clear, bright, and a genial sun. One of the first persons I met on entering the grounds, was the active and stirring president, our honored brother Clement, who in giving the right hand of welcome, directed me first to the new and commodious stock sheds. These I think a great addition to the grounds, and although there might be better plans for permanent buildings, I would not withhold saying that the Middlesex North has made a good investment here of capital that will be appreciated in future years.

A portion of the stock had been removed, but the best I found still at their posts. In the line of oxen, I would claim the privilege of making mention of those shown by Messrs. N. Pierce of Lowell, D. B. Jones of Dracut, and H. A. and S. A. Coburn of Lowell; and as I looked on them, the thought entered my mind that the societies of Western Massachusetts, with their boasts of excelsior cattle, would be proud to class such in their exhibitions. Of cows there was a good display, the Jerseys or their grades predominat-

ing. I note some few Ayrshires, and in commenting at length, would speak in high terms of the full blood of this breed, shown by Dr. J. C. Ayer, as also the Jerseys shown by W. E. Livingstone and E. M. Reed, the last from stock imported, as I was informed, by himself. The display of heifers was very fine, and it was with pleasure I viewed the class, knowing that too often it is passed by as if of little consequence, when in fact it is one of the most important, for from the heifers come the cows to be. None but the best should be permitted to come to maturity; if signs are seen or time proves that the heifer will make but an inferior cow, let the butcher avail himself of her carcass. Through this way I think, and this alone, can the standard of excellence of our dairies be raised to a level, that they may be even profitable.

The bulls were out in good numbers, (thirteen,) and I am sorry to say that grades were in attendance; yet I trust the time is soon to come when all such shall be ruled from privileges of premiums. I would only refer to the noble Durhams shown by Z. P. Proctor, of Dunstable, and also D. S. Wood of Tewksbury.

Sheep I saw in but two pens; while of swine the show was from the "titmouse to the fat porker," each trying for premium.

Poultry was in a commendable and fine display. The ploughing and drawing match I regret much not being in season to witness, but it was reported to me as good in both.

Of the horses exhibited, I would say that I saw no "jockey ring;" the exhibition was for the farmer, the track not being used to any extent. Having no opportunity to see the various points of excellence in this division of the show, I would not speak of it in detail, but pass it on its merits as all very good.

The hall calling my attention, I was surprised on entering, at the full tables of fruit that first met the eye,—apples in the centre on a long and full table, pears to the right in profusion, and at the left of the entrance the fruit of the vine (grape) was the crowning part of the exhibition, I can truly say the best I ever saw. Leaving the grape and turning again to the left, I entered the vegetable department, and found potatoes, squashes, cabbages, melons, &c., &c., in their allotted places, the Early Rose potato predominating. Triplet squashes from one vine in a total of three hundred and fifty and a half pounds weight, the heaviest one hundred and fifty-seven.

I saw but a small amount of grain, while the table of bread, honey, butter, (no cheese,) was well filled. Time and space will not permit me to speak at length of the many fancy articles, the assortment was so large and varied, and the only mention under this head is the specimen of spinning and weaving manufactured

one hundred and eight years ago, 1762. In the mechanical department, the labor-saving implements are recognized in mowing machines, "Lightning Churn," knitting machine, and three or four sewing machines. Receiving here a call, I found myself conducted to the large dining hall, where seated on the stage I found myself among numerous honorables, majors, colonels, doctors, &c., and while waiting for the closing feature of the day and speculating on the dignity and honor around me, the home power shown by the Middlesex North, the thought came to my mind that the debts of this Society should soon be cleared, and stand as one of the first in the Commonwealth. The gathering was called to order by our brother Clement, who, after a few pleasant remarks and introduction of your humble servant, turned the meeting into the hands of the toastmaster, Mr. George A. Marden, who filled the place admirably, calling on one and another for remarks, as also the "Dunstable Band" for select music, till the hour of the afternoon told that the shades of evening would soon cover all nature, and thus the time had come to close the "farmer's holiday." In closing this report, I would not pass the idea shown out by several of the speakers, that this exhibition was not on a *par* with former years. All I would say is, I think it not quite good policy to tell of a fault always, though it may exist. I see no cause here to murmur, and as the Society now stands, with excellent buildings, I see no reason why it may not have a happy and prosperous future. My visit here was hurried, but I shall long remember it with pleasure, as also the cordial hospitality extended to me by the president and officers of the Society.

E. W. Boise.

WORCESTER.

The Worcester Agricultural Society held its annual exhibition on the 23d and 24th days of September, 1869, on the spacious and commodious grounds belonging to the Society. Rain had fallen on the 22d, and the evening of that day was dark, lowering, and indicated anything but an auspicious dawning of the morning of the 23d. To the surprise of every one, however, the day dawned brightly. Old Aurora shone out in splendor, her rays first glancing on the hill-tops, and then through the valleys. The rain of the preceding day had as effectually *grounded* the dust as ever sterility was laid by the more scientific and practical agriculturists of the present generation. Being in the vicinity, we wended our way to the show at an early hour, but owing to the dampness of the soil,

as we judged, found but few persons assembled except contributors. As the morning advanced, however, the people began to gather from all points of the compass until eleven o'clock, when there was quite a respectable number in attendance, both of visitors and contributors to the exhibition.

Our attention was first attracted to the various breeds of blood stock tied up to rings attached to the stone posts which supported the high board fence on the westerly side of the grounds. The spaces between the posts also were filled with attachments and fastenings, which were all occupied; and twenty feet or more in the rear of the fence row was another, fastened to strong wooden posts, making two rows of cattle, some twenty-five rods long, and each man's lot pretty closely packed together, and but a narrow space between the several lots. There were also many cattle tied in other localities, but only a few in the pens. There were one hundred and fifty thoroughbreds on the grounds, grade and native cows, with working oxen of all grades and classes except inferior, in almost unlimited numbers.

Each breed of stock had its section of space set apart, thus facilitating the labor of committees, and upon examination of the various lots, we came to the conclusion that somewhere in Worcester County there must be luxuriant pasturage, and if they do not *grow* corn, they surely found it elsewhere. Those bony and meaty Shorthorns at least indicated as much.

First in the order of our examinations were 8 cows, 1 heifer, and 3 bulls, by Augustus Whitman, of Fitchburg. Shorthorns.

J. E. Waters, Millbury, 1 4-years old bull, 5 cows, with young cattle—10 in all. Shorthorns.

O. E. & E. O. Chafin, Worcester, 5 young Shorthorns.

Stephen Salsbury, of Worcester, 1 Shorthorn bull.

B. J. Stone, of Sturbridge, showed 12 Ayrshires of his own breeding, and fine animals they were. One cow 8 years old, from which said Stone has sold $1,200 worth of stock. The cows, Bessie and Effie, seemed like remarkable animals.

Wilson Walling, of Millbury, 17 thoroughbred Ayrshires, among which were 1 fine-looking bull, 6 cows, the balance younger stock.

Benjamin Harrington, Worcester, 11 well-appearing cows, calves and intermediates. Ayrshires.

J. W. Wetherell, Worcester, 8 thoroughbred Ayrshires.

L. H. Rice, West Boylston, 3 Ayrshires.

W. M. Coe, Worcester, 4 Ayrshires, thoroughbred.

David R. Gates, 1 thoroughbred Ayrshire bull, 4 years old, and nice.

William T. Merrifield, of Worcester, 20 clean and beautiful Jerseys, of the two sexes, and various ages.

O. B. Hadwen, of Worcester, 16 thoroughbred Jerseys. Good.

Joseph Burnett, Southborough, 8 Jerseys.

John Brooks, of Princeton, 1 excellent bull, 9 milch cows, 5 heifers and calves,—15 in all, and handsome as pictures.

Joseph Lovell, of Worcester, 1 fine 2-years-old heifer, $\frac{1}{2}$ Jersey, $\frac{1}{4}$ Durham, $\frac{1}{4}$ Ayrshire, large; also, one 1 year and three months old, same grade. Very good.

There were many grades present, and of a variety of crossings, well developed animals in the main, but we cannot stop to enumerate them. From the lunatic hospital at Worcester, there was one yoke of Durham oxen, of 4,320 lbs. weight, and one pair 4-years-old steers, same breed, weight, 3,650 lbs. Also, large cows, said to be pure bloods, and grade Durhams, from the same place. The cattle showed no indications of lunacy, but of others we write not.

There were on the grounds some Devons also, the more as grades, and, judging from what we witnessed, Worcester County must be alive to the breeding and improvement of her dairy stock, evincing a laudable spirit in that direction.

Of swine, there were two lots noticeable. One, a sow and ten pigs, from the city hospital and almshouse, Worcester, $\frac{1}{2}$ Mackey and $\frac{1}{2}$ Chester County white. Appeared well.

Calvin Cutter had a sow and 43 of her progeny, of various ages, Chester County and fine.

Obviously, whether right or wrong, but little interest is taken in pigs there. In our judgment, any good breed of swine, if regularly supplied with food, a good shelter, with abundance of turf and muck in the yard, to protect the solid and strain the liquid manure, may be made a source of profit to the owners.

The Poultry department contained a variety of such breeds as is usual on such occasions.

The Ames Plow Company was well represented in the Machine, Tools and Implements department, by some twenty-five different patterns of ploughs, hay-tedders, horse hay-rakes, lawn-mowers, seed-sowers, &c., &c. It reminds me of a statement of Frank M. Ames, of Taunton, last winter, which was this: The Ames Company sell $3,000,000 worth of agricultural tools, yearly.

The ploughing match was contested by fourteen single, four double, and two horse teams, and on the Society's grounds, east side, and a portion of the land was very wet, exceedingly tough sward, and other parts less difficult to manage. Of course, quick work under such circumstances was out of the question. The

ploughmen appeared to be skilled in the business. Good training was manifest in the teams. The work was well and leisurely done, and, what pleased us much was, there was but little *music* of the *lash.*

In the hall, it was evident the ladies had not put forth much effort to make a show. There were, however, a few samples of needle-work, and some cut flowers. Of pears and grapes there were few. The Concords were well ripened. Among the apples, which were generally good, the Gravenstein, Porter, Lyscom, and Fall Harvey were larger than usual, for those sorts. There were a number of plates of peaches, some of which were fine.

It was clearly manifest that the horticultural exhibition which was going on at Horticultural Hall, on Front Street, had monopolized the fruit, leaving, as it did, a meagre show for the agricultural grounds. We judged there were good market gardeners in Worcester and vicinity, from the fact that vegetables in variety, and of good quality, were on the tables. Among the roots which were *not* for the table, were a dozen mangolds which averaged fifteen pounds each. Excellent butter, and cheese of various complexions, and marblings with different herbs, were shown. After partaking of an excellent dinner, which was served in the upper hall in the Society's building, General Butler addressed the multitude some forty minutes, in which time he reviewed the *blue book* of 1869, in order to show what Acts, if any, had been passed for the benefit of farmers. He succeeded in finding that an appropriation of $50,000 for the agricultural college had been made.

After the address, the hall was soon cleared of bipeds desirous of witnessing the performances of quadrupeds upon the track. Worcester contains a goodly number of horse fanciers, and by three o'clock an immense throng had gathered to view the races.

Our thanks are due, and cordially tendered, to the officers of the Society and others for courteous attentions.

Asa Clement.

WORCESTER WEST.

On my arrival at Barre the morning previous to their cattle show, the sound of the drum, ringing of bells and the booming of cannon, reminded one strongly of the days of secession, when our young men were buckling on the armor of war to defend the Union and the "starry flag." On inquiring the cause of this excitement, I was told that the governor and his friends had arrived. With

such an *extra* beginning it was but natural to expect an *extraordinary fair*.

The *weather* on the morning of the first day was very fine, and by nine o'clock the grounds of the Society presented a very lively appearance. But, as usual, when so many have a finger in the pie, it took a long time to get into working order.

Some departments of stock were well represented, especially *working oxen*. Several good pairs were exhibited on a cart loaded with stone. They did credit to themselves and their owners.

There were some very fine herds of cows, mostly of the grade Durham; some Ayrshires and a few Jerseys, with quite a number of grade Dutch.

I saw but one thoroughbred bull on the grounds. That was an Ayrshire, and a very good specimen. The others were inferior grades—unworthy to compete for a premium at a fair.

The show of fat oxen, though limited, was very good. There were some fine steers and young stock.

The principal object of stock raisers in this section seems to be—not the *improvement* of the stock—but to produce the most milk for the cheese factory. We think our friends will in the end find this to be a mistake. The ploughing match on the grounds was well conducted, and the work, done mostly by oxen, was well performed.

The sheep were few, but very good,—a very nice selection of Southdowns.

Swine were scarce, but of good quality.

The second day was devoted exclusively to the exhibition of horses. I hardly know whether it belongs to me to report on this day's programme, as I understand it was under the direction of a set of fancy horse jockeys. How the premiums were paid is more than I can tell, but suppose to the satisfaction of all concerned. The exhibition in some respects was very good. The entry of stallions was small, and the animals of inferior quality. There were a few pairs of carriage and draft horses—some very good ones.

The class of *colts from one to four years* old was well represented. Some were excellent. One belonging to Mr. Mixter, of Hardwick, two years old, attracted universal admiration.

I have always advocated the trial of speed at our exhibitions as a means of improvement, but I cannot approve of the extent to which it was carried here, nor the way in which it was managed. I do not believe that such a course is beneficial to the community, or profitable to the society that permits it.

One part of the programme was very attractive. Three fine

young ladies appeared on horseback, and gave an exhibition of their skill in riding and managing their ponies, over which they seemed to have perfect control. They won universal applause.

The hall was filled with the usual variety seen at such exhibitions. A very good display of handiwork by the ladies, both useful and ornamental.

Fruit of all kinds was good, some very fine.

The dinner prepared for the occasion was served in the upper hall to a company of 250 or 300 persons. Though a bountiful repast, it was nothing to the intellectual feast which followed. The wisdom of the State was there, and for an hour or two there was no lack of wise sayings or merry jesting, with which an appreciative audience were both edified and amused.

H. S. Porter.

WORCESTER NORTH.

The annual exhibition of this society took place in its spacious and conveniently arranged grounds at Fitchburg, September 28th and 29th. The weather was fine, and the exhibition highly creditable to all concerned. The cattle sheds are ample, and substantially built and roofed, where the animals brought for exhibition can be safely and comfortably sheltered in case of storm. On this occasion they were well filled with animals that are seldom equalled at a county show. The large herd of Shorthorns of A. Whitman, of Fitchburg, made a splendid show, and contained many individuals of great excellence. Joel Page, of Fitchburg, also showed some fine animals of this class.

E. T. Miles, of Fitchburg, showed his fine herd of Ayrshires, whose milking qualities might be safely matched with the more stately Shorthorns of his neighbor. L. H. Rice, of Boylston, showed an uncommonly fine Ayrshire bull and heifer.

The Jerseys were represented by the excellent herd of John Brooks, of Princeton, and also some fine animals of this class by I. F. Brown, of Lunenburg.

In grade cattle the show was very good. The cows, steers and working oxen are seldom surpassed. The grade bull was there also, and took a premium, I am sorry to say. Your delegate hopes and believes that the Society will see that it will be to their advantage to offer premiums only to pure-bred bulls, for from such only can they expect any decided improvement in the herds of their section. Horses for draft, driving and breeding were well repre-

sented, and the fast drivers were tested in the usual way to the gratification and amusement of the large concourse of people who were constantly in attendance at this, as well as all parts of the show.

The hall (a model in its way) was well filled with the products of the orchard, garden, field and workshop, not omitting the handiwork of the ladies. On the whole, the managers may congratulate themselves on the success of their exhibition of 1869.

WM. BIRNIE.

WORCESTER NORTH-WEST.

The memorable storm of the third and fourth of October, 1869, will be long remembered by the people of the middle and western parts of the State. The damage done to the railroads was so great as to delay their operation for days, and in some instances for weeks. Bridges, mills and dams were swept away, and nearly every highway rendered unfit for travel. Amid such difficulties I attempted to meet my appointment to the Worcester North-West Agricultural Fair at Athol, the fifth and sixth, and but for the advice of our indomitable friend and associate, Dr. Loring, I should have abandoned the undertaking in despair. The doctor was to be met with *everywhere* at that season, either going or coming, in the fulfilment of his numerous engagements in the interests of agriculture. He was then on his way to Princeton to address the Farmers' Club at their annual town exhibition, and kindly invited me to take a seat in his carriage and accompany him thus far, and trust to luck for the means of pursuing the rest of my journey. I swallowed the pill, and would say, that if all the doctor's prescriptions are as palatable as in my own case, I do not wonder at his extensive practice. But his practice is purely vegetable, always recommending his *turnip elixir* as the universal panacea.

Shakspeare says there is a destiny that shapes our ends, and it seemed a kind dispensation of Providence that the angry elements should have turned me from the direct route to Athol, and carried me to the Princeton Hills to witness one of the best town shows I ever attended, and, if I mistake not, even excelling some of the societies that receive the patronage of the State.

After partaking of the kind hospitalities of this place, for which I am under many obligations, I left for Hubbardston, passing through familiar scenes—scenes linked with my childhood's earliest thoughts

and recollections. Ah, what is holier to a man in his later years than the associations that cluster around the hills and fields which his boyish feet have trod. They make him a child again. Say what we may,

> "We owe
> Well more than half life's holiness to these,
> Nature's first lowly influences."

The dangerous condition of the roads compelled me to take the by-ways and lanes, lengthening my route many miles, reaching Templeton late in the evening, cold and weary. I remained here over night, expecting to find some one in the morning going to Athol, eight miles distant, with whom I might secure a passage. As no one was known to be going thither, and there was no public conveyance, a lady gallantly offered to take me there in her own carriage. The kind offer was accepted, of course; so off we started, she handling the ribbons in a masterly manner, taking the dust of no one on the road, within the hour delivering her charge into the hands of President Fay at the fair grounds. This kind consideration from a stranger, and a lady, placed me in a new relation, and caused me to keenly feel that

> "The heaviest debt is that of gratitude
> When it is not within our power to repay it."

On my arrival I found the exhibition in full tide of operation, and the grounds literally covered with an admiring multitude of people.

The grounds embrace twenty-one acres, including a fine grove of large trees, with a beautiful pond on one side, and when all the arrangements are perfected according to the proposed plan, they will constitute one of the most beautiful fair-grounds within the State.

The half-mile track is laid out in oblong shape, giving a home stretch equal to any mile course. A good substantial hall has been built, 100 by 50 feet, consisting of two stories and a basement. The exhibition room and offices are on the first floor, the dining-room above, and the cooking department below in the basement. A barn has been erected for the storage of hay and grain, and for the accommodation of horses and other animals. The whole cost of the grounds, buildings and improvements, has been about $14,000. This has all been accomplished during the present season, and the whole arrangements are admirably adapted to secure both the comfort of visitors and the convenience of contributors. My arrival being delayed until a late hour on the morning of the second day prevented my examination of the cattle department, which was

assigned for the first day. But the display was said to be very creditable. The entries of cattle of all classes numbered about 400, twenty-two being thoroughbred. There were twenty entries of swine and twelve of sheep reported.

As usual, *the horse* was the great outside attraction of the second day, more than fifty entries being made. There were some fine animals on the ground. I noticed one fine team belonging to C. C. Bassett, our worthy associate from that Society. I presume his modesty would not allow him to compete for a prize.

The exhibition in the hall was of a high order, every department being well represented. The vegetable department gave evidence of good cultivation. Fruits of every variety and beautiful flowers graced the tables, such as would have made the eyes of Flora and Pomona sparkle with delight. I am not sure but these fair goddesses may have a summer residence in some sunny nook among the hills in this vicinity. Excellent specimens of bread, butter and cheese, in the domestic department, well attested the skill of the good housewives and daughters who contributed them. The needlework was very superior; there were hundreds of specimens, from the magnificent carriage affghan to the most elaborate hair and worsted work. It would be invidious to individualize where all was so praiseworthy. Mr. D. A. Corey, of Fitchburg, had a fine display of ladies' and household articles. It was a perfect "bower of taste."

The mechanical department was less fully represented than it deserved to be as the associate of the agricultural. The dinner was worthy a farmer's festival, and was enjoyed by a large company of both sexes. But the crowning event of the day was the address: subject, *The Obligations of the State to Agriculture.* It was common sense illustrated, and worthy the head and heart of our friend the orator, Professor Stockbridge. I have nothing but praise for this young and flourishing Society, which already takes a high position among the agricultural societies of the State. The management is in good hands, whose ability to guide her on to full success is only excelled by their generous hospitality.

ELIPHALET STONE.

WORCESTER SOUTH.

The annual exhibition of the Worcester South Agricultural Society took place at Sturbridge on Thursday and Friday, October 7th and 8th. The weather was all that could have been desired.

On the morning of the 7th the people early flocked to the grounds, where the first thing to attract attention, as per programme, was the ploughing match, which was spiritedly contested by ten single ox teams. The ground was a sandy loam, turf not very strong, with a few small stones in the soil, which rendered it difficult to turn a smooth furrow; but notwithstanding these difficulties the work was well done. All the ploughmen were entitled to a premium, and all got one. After the ploughing came the trial of working oxen and steers on the cart with 3,000 lbs. of stone. This exhibition was very fine; it showed that the men and boys of Worcester County knew how to train their oxen and steers well. There were about fifty pairs on the ground; the Durham, Devon and Ayrshire blood predominated, but all were so excellent it was difficult to discriminate between them. I would mention as worthy of note one bull and a herd of cows belonging to Alpheus Davis; one Shorthorn bull three years old, weighing 1,700 lbs., twelve cows, one thoroughbred, and twelve head of young stock, all high grade Durham, exhibited by Daniel Dwight, of Dudley. Nine head of grade Devons, by Byron W. Charles, and twenty-two head of Ayrshire, by Bela J. Stone, of Sturbridge, attracted much attention. The show of swine and poultry was good. Sheep was an exception; very few on exhibition. The dinner-hour had arrived, and a large number of persons sat down to a well-provided dinner-table, at which the president of the Society presided. After dinner we retired to the upper hall, which was filled to overflowing with ladies and gentlemen—as intelligent-looking an audience as can be found. The president then introduced the Hon. Levi Stockbridge, orator of the day, who gave us an excellent address, defining the duties of the State to agriculture. Of the numerous articles in the hall I shall have to speak in general terms. There was a good show of vegetables of all kinds, of fruits and flowers, and the ladies had done their full share in contributing to the useful and ornamental department of the show. There were but few agricultural implements exhibited. There was in the hall some fine augers and bitts from the Snell Manufacturing Company, and some fine carriage harnesses from Zebulon Morse & Son.

The second day was given to the horse. There was a fine exhibition of breeding mares and colts, showing both care and skill in their breeding; also a fine show of carriage horses. There were five entries for fast and light work, and they did it up to the satisfaction of your delegate, and, I presume, to the farmers generally. Finally, I think great credit is due the officers of the Society for their exertions and skill in the arrangements, and the people of

Sturbridge and neighboring towns generally, for the interest shown in making this show, as it was, a decided success. There were judged to be 5,000 people on the ground; there was no rowdyism, and your delegate did not see a person intoxicated during the two days of the show, which speaks well for the morals of the people. In closing my report I with pleasure make mention of the cordial reception I received as the delegate of the State Board from the president, Sylvester Dresser, Esq., and the secretary, Avery P. Taylor, and others, and their kind attention shown me during my stay rendered my visit to that Society very pleasant.

JOHN A. MORTON.

WORCESTER SOUTH-EAST.

Agreeably to my appointment by the State Board of Agriculture, I visited the fair of the Worcester South-East Agricultural Society held at Milford, — their tenth annual exhibition, — in company with its president.

It was a beautiful frosty morning, and although we were early, we found the grounds and hall fast filling up with all ages and classes of men, women, and children; some evidently had taken a long, early ride, all eager to enjoy the whole of the "cattle show."

The cattle pens were very rapidly filled, so that before eleven o'clock the pens were full, and some fastened outside. The cattle generally looked well, although some showed greater care in breeding than others. There were not as many full bloods as I had expected to see. All the different breeds were represented except the Durhams, the Jerseys being the most numerous. I noticed some grade Jerseys which appeared to be deep milkers.

There was a very fine Ayrshire bull exhibited by the president, Mr. Knowlton; also a fine little Brittany cow and bull which he is anxious to test. He speaks very highly of the "Pet."

This breed is a new kind to me, but from what I saw of it, I think they may be valuable as pets, and on gentlemen's lawns to supply their tables, and children with pure milk.

The exhibition of beef and sheep was very small. Swine and poultry were well represented.

I found the arrangements had been made to exhibit both cattle and horses on each day. The show of working cattle and trained steers was excellent, and the ploughing with oxen very good; the ploughing with horses on the first day was well done.

More attention was paid to the breeding of horses than I had expected to see. There were some fine colts, of all ages, entered, and a good show of carriage, farm, and working horses. The show in the hall was very excellent, all being arranged in perfect order, showing that great care had been taken in the preparing and carting of the vegetables. The hall was very neatly decorated, and nothing was wanting in the way of vegetables, grains, fruits, flowers, and works of art, to make it beautiful and attractive.

The bread and honey I should pronounce good from their appearance, but the butter I did not call first quality, as I had a chance to taste as well as look at it. There was no cheese presented.

The show of agricultural implements was not large.

Your delegate was much pleased with the arrangements in general which governed the fair, and all the committees which came under our notice seemed to be composed of men who took an interest in and were competent to discharge their duties. They examined the stock and questioned and cross-questioned the attendants in such a manner as to show that they knew what they were talking about. We were highly pleased with the hall; it is well adapted to the wants of the Society. The grounds and track were well located and in good order; but we were surprised to learn that the Society did not own the track, but did own the hall. This seems to us not what it should be to make the Society prosper, and have everything pass off pleasantly; they should own the track as well as the hall and pens, and thereby have the whole control at all times.

We were informed that the rules of the Society require that the stock shall remain in the pens until the second day at three o'clock; they are to be fed and watered at the expense of the Society. This is very desirable where the fair is held two days, provided the stalls are convenient for the exhibitor. In the judgment of your delegate there should be covered stalls provided for all stock which is required to remain, whether it be for such as take premiums or not; also a comfortable place for the attendant who has charge of the same. In this way, those who have the stock in charge will take pride in keeping it looking neat and worthy of being on exhibition, which is the aim of the second day's show. In this way, with feed, water, and bedding, no one who has any good stock can object to leave it until the second day.

It seems to us there must be an objection to some bringing out their stock, knowing the rules, and the accommodations the Society is able to furnish. We are of the opinion that the bounty of the Society received from the State is doing good, and should be con-

tinued for numerous reasons. One is this: the Society offers a premium for improvements on swamp lands. I have been informed of one piece entered, the improved value of which is $180.

In all probability had there been no bounty there would have been no society; no society, no premium; no premium, no improvement in the swamp land referred to here.

The second day of the show opened with a trial of working and trained oxen. The number of contestants was unusually large. The cattle were generally finely matched, as to color and physical resemblance, and presented a symmetry of form rarely excelled. The work also was better done, on the whole, than at any other exhibition of this Society. Throughout this trial, with but very few exceptions, there was shown a docility on the part of the cattle, and intelligence and humanity on the part of the drivers and trainers, which argues well for the future. Dumb animals, like children, show at once, by their manner, the treatment they receive from their teachers or masters. A disturbed and apprehensive glance of the eye, a cringing obedience, or a defiant manner, indicate the tyranny of those under whom they are tutored. A trusting, loving look, and a confiding action, at once assure you of the humanity of their instructor. A true appreciation of brute intelligence, and a manly treatment of it, are rewarded by an obedience that seems to have the divine quality of love in it. They, under such a master, work with a will. Much of this was manifested at this trial, both in ploughing, and drawing, and backing. The shouting and whipping were generally abandoned, and a few decisive words and motions, understood by the cattle, accomplished the work marvellously well. The high character of this part of the show was attested by the interest and enthusiasm of the crowds of spectators who were held here in spite of the other great attractions on the ground. The satisfactory character of this exhibition was crowned with one, where, even in a higher degree, the capacity of the cattle and the nobler and humaner spirit of their masters were revealed. Three yokes of oxen, two pairs of steers, and one pair of calves, six months old, were unyoked and began, under their drivers, to show us what patient kindness could do with the ox, which has been called a stupid animal. Their capacity seemed to respond to almost any test. At a word they went forward together, or one went forward and the other backward. They changed places with each other, nowise embarrassed by finding themselves on the off or near side. By a motion, a foot was held up, as if to offer a hoof instead of a hand. At a blow, or succession of blows, on the ground in front of them,

and a command, they laid down and allowed their trainers to crawl between their legs, and there lie, or sit at ease on their backs. In a word, they went through evolutions not unlike soldiers on drill, or a cotillion set at the call of the prompter.

The calves were trained and managed by a boy of twelve years of age, who commenced with them when they were six weeks old. Their evolutions were not as complicated, but in the same direction as those of the older cattle, and as far as they went, they did their parts well.

The society for the prevention of cruelty to animals would have rejoiced, we think, at this exhibition had it been before them.

It is said the great mind of Daniel Webster turned from the maze of politics and the deceits of men to his home at Marshfield, and found not only the solace of domestic life, but as he looked into the broad, honest faces of his oxen, an appreciation of kindness that made him forget the ingratitude of men.

When we saw the intelligent farmers thus drawing forth the obedience and love of their oxen, we felt as if they, too, might appreciate what the profound insight of Webster saw in his cattle, years ago, at Marshfield.

Our sincere thanks are due to President Knowlton for his kind hospitality and the pleasant acquaintance made with his family, and friends. JOHN T. ELLSWORTH.

HAMPSHIRE, FRANKLIN AND HAMPDEN.

Owing to the very heavy freshet which occurred October 4th, and did so much damage to roads and bridges, and the consequent delay of the trains, I did not arrive on the grounds of the Hampshire, Franklin and Hampden Society until four o'clock in the afternoon, and not in time to witness much of the first day's show. There were a few cattle from the immediate vicinity, and two large herds that had been brought from a distance, which remained on the ground overnight, and I had an opportunity of seeing them the next morning.

One of them was the very excellent herd of the Messrs. Anderson, of Shelburne Falls, the well-known breeders of grade Shorthorns. Seven of the cows, I was told, were valued at seven thousand dollars, and the remainder, to the number of twenty, of corresponding value, according to age and merit. While looking over and admiring this herd, which had been bred with such care and

discretion as to symmetry and dairy qualities, I could not help heaving a deep sigh and saying to myself, If they had only good recorded pedigrees! and I was also very sorry to learn that these gentlemen had abandoned, in this the height of their success, the use of thoroughbred bulls. If these gentlemen had used corresponding discretion in maintaining pedigrees of their cattle, at a comparatively small additional expense that they have in breeding and management, the value of their herd would have been more than doubled, and their customers for them would be legion.

The other herd, which I was also much gratified in seeing and examining, was the beautiful herd of Alderneys belonging to Mr. T. M. Stoughton, of Gill, about twenty-five in number, and each one a specimen of itself. Mr. Stoughton is one of the pioneers in breeding these Alderneys in the country, and he has certainly succeeded in producing an excellent herd. As we went around among them while they were feeding on the grounds, each with a different-sounding bell strapped about its neck, and under the light of as beautiful a day as I ever saw, amid the grand views of that matchless valley, my joy was complete. (If of a poetical nature I should insert a few lines here.)

I regretted not seeing the entire show of cattle the preceding day, but was told that it was very good.

The number of horses on exhibition was very large, and included many good ones, and some which, I presume, the owners found, in getting them near others, were not as good as they thought them to be before comparing side by side. And just here seems to me to be the prime object of our fairs. They enable the farmer to form opinions by comparison as to the quality and value of his stock and farm productions that he would not otherwise have an opportunity of doing. I noticed an extra fine span of business horses belonging to our friend, the delegate from that Society.

The trotting in the afternoon was spirited and interesting, and some fast time was made, the best heat being in 2.33, the excitement of which was added to by one horse running away and tipping out his driver in three consecutive heats, thereby enabling some that were behind to come in first. How many times it would have been repeated without breaking the driver's neck I can't say, if he had not been ruled off by the judges.

The exhibition of farm machinery was not very large nor attractive.

The display of fruits and vegetables, and fruits in particular, was

the finest that I saw at any fair that I attended during the fall, not excepting the New York State, held at Elmira; and the other departments in the hall were well represented.

The Haydenville brass band furnished most acceptable music, and this always adds largely to the interest of all public occasions. The attendance was very large, upwards of five thousand we should judge, notwithstanding the bad condition of the roads, and the necessity in many cases of going a long way around on account of missing bridges.

The management of this Society is at present in the hands of thorough-going, practical and successful farmers, and who by their own success are rendered doubly fit to manage for the public; and as I left, I did so with the sincere wish that the worthy and venerable president, Mr. Milo J. Smith, might be spared and allowed to preside over many fairs, and all as successful as the one then drawing to a close; also, the gentlemanly and courteous secretary, Mr. Elnathan Graves. G. T. Plunkett.

HAMPSHIRE SOCIETY.

The annual exhibition of the Hampshire Agricultural Society, was held at Amherst, September 28th and 29th. The location of this Society, in the neighborhood of the Agricultural College, gives its operations unusual interest to the farmer; and there can be no doubt that the character of its exhibitions will ultimately be materially influenced by the investigations carried on at that institution. The exhibition, as examined by your delegate was a good one. The show of working oxen was, as usual in that section, worthy of careful attention; and it was peculiarly gratifying to witness the interest taken by the members of the Society, in this most useful, and now too much neglected form of animal labor for the farm. The value of a good working ox should not be overlooked. Not only is he important in the general business of the farm, but that form best adapted to labor, is usually attended by those qualities of thrift, and shape, and constitution, which are to be found in animals best fitted for the shambles. It is encouraging, therefore, to witness all endeavors to keep our working oxen up to the standard of a solid, well-made animal. A farm well supplied with cattle of this description, has generally been conducted in a thrifty and profitable manner. And it is to be hoped that a good ox-team will continue to be the pride of the New England farmer.

As might be expected, in a region where oxen still enjoy the respect of the community, and the pastures are still luxuriant, the display of fat cattle was very fine.

Of dairy stock there was an excellent representation. The cows were of medium size, well developed, and admirably adapted to the service assigned them. The introduction of good blood into that section of the State, has produced that good effect which we have a right to anticipate. And it is a question, whether, in view of these facts, it is desirable that this Society should continue to offer premiums for grade bulls. It is generally understood that pure-bred bulls of any breed, are more beneficial to the farmer that any grade can be, unless a family has been created of such high quality that the owner is desirous of continuing it in all its characteristics. But these instances are rare. Scarcely can a breed, large or small, be found, that cannot be improved by the introduction of good, pure blood. And this being the case, it is a matter of great importance for a Society to decide how far it should go in encouraging the use of half-bred males.

The show of stallions and breeding mares was excellent; and the trial of speed upon the track was confined to horses of utility, and not opened to those whose sole merit is speed, regardless of other qualities.

To speak in terms of commendation of the sheep, swine, poultry, and manufactures of many descriptions, would be merely to repeat the general opinion of those who examined the exhibition.

The affairs of this Society are in good condition, and indicate a determination to fulfil the design of those enterprising gentlemen who long ago provided ample grounds and a fine hall for its purposes.

Geo. B. Loring.

HIGHLAND.

At the last annual meeting of this Board I was appointed to attend the Worcester West Agricultural Society Exhibition, to be held at Barre in September. After accepting that appointment I found the time came on the same day that the Nantucket Society held their fair, where I felt bound to attend. From this I arranged with Mr. Porter to go to Barre, and I attended the Highland Society Exhibition, held at Middlefield, September 16th, where I found a fine collection of cattle, comprising many valuable thoroughbreds of different classes, and many exceedingly fine grades. The

brood mares and colts and stock horses were of the best stock in the State. Other portions of the show were well represented by swine, sheep and poultry. In the hall was a fine collection of fruits, flowers and all the home manufactures contributed by the skill and tastes of the ladies, and no such exhibition is complete without their coöperation. The bread, butter and cheese were of excellent quality, so far as your delegate could judge. On the evening of the first day the hall was packed full of earnest listeners to the well selected pieces of music by a select glee club, and the well chosen remarks offered by many gentlemen present. On the second day the general exhibition of horse stock took place, but not on a full course track, as nature has decidedly arranged the rocks and hills in such a manner as to preclude such a course, unless by an extravagant outlay. The address was delivered by Professor Stockbridge, who is at all times ready and willing to add his voice and knowledge in the cause of agriculture.

After noticing the exhibition as a whole, I am happy to report that, in the judgment of your delegate, this Society is striving, through its officers and active members, to develop the resources of the Highlands, on which nature has seemed to defy the skill of man to add to his means of transportation any method better than the old ox or horse teams; and I would suggest to the farmers on these hills to adopt a course of farming by raising cattle, sheep, swine, and the grains, roots and pastures on which to grow this stock, from which butter and cheese could be produced and marketed with but little cost of teaming, as much of the stock could be sent to a market on the foot; and again, the cattle would return to the soil in manure such elements as were extracted by the crops. Respectfully submitted.

James Thompson.

HAMPDEN.

Another year in the history of agricultural societies has passed, and it is expected from its executive officers some account of its progress and prospects. Experience has not removed the conviction that every member of an agricultural society is responsible, in a greater or less degree, for the success of said society. If one sees a deficiency in the show of horses, cattle, sheep or swine, or in the show of fruits or vegetables, or in any department of the show, let him see to it another year that he or his neighbor supply the defect, and by so doing bring out a good show, and encourage the officers of the society as well as agriculture. The twenty-fifth

annual cattle show of the Hampden Agricultural Society was held on the grounds of the Hampden Park, October 6, 1869. My visit was unexpected, but in the absence of the regular appointee, Hon. Mr. Davis, of Plymouth, my services as reporter were requested by Mr. Birnie, of the Board, and the efficient and worthy secretary of the society, J. N. Bagg, who has served the Society in that capacity for ten years in succession, and was re-elected at the annual meeting of the Society.

It was hoped by the friends of the Society that the annual October exhibition might be a success, the Society having offered $1,500 in premiums. But the attendance was not large, nor was it difficult to assign the reason. The great flood of October 4th detracted from everything, agricultural fairs in particular. No one was responsible. If water had been the only element necessary to carry a show, it would have been a success.

Mr. Wm. Birnie was on the ground with his fine herd of Ayrshires, the best in the State, furnishing his own pens, and refusing a premium. Mr. Alden Warner exhibited his herd of Herefords, which added much to the show. Longmeadow took the first premium on town teams, among which were the well trained steers of Messrs. Converse and Pease. Mr. A. Webber exhibited the best pair of oxen on the ground, weighing 4,340 pounds.

The show of milch cows was not large, but very creditable.

But few horses were on exhibition; a few pairs of work and some fine saddle horses, and several nice colts.

The show of fruits, vegetables and the nicer things of art, of which there was a fair display, was removed from the City Hall to under the grand stand on the grounds.

The exhibition of agricultural implements was not large. Schenck's potato digger would have been on the ground but for the flood.

This Society has the most valuable park or fair ground of any in the State, and its members possess thoroughbred stock of the different breeds sufficient, with a little more *zeal*, to make one of the best shows in Western Massachusetts.

Agricultural fairs do much to overcome the growing unwillingness of the New England youth to engage in farming. The increase of fairs is a positive advantage; a stimulus to agriculture, besides affording an innocent amusement to all. The State has long understood this, and hence the pecuniary aid and encouragement she has extended to every society in the State.

In the various combinations of wood and iron which are employed in agriculture a great improvement has been made, yet a *farmer* must use his *brains* as well as his muscles.

In mechanics, in science, commerce or law, it is understood that the man who is the most truly alive to his calling is the one that wins. The same really is true in regard to farmers. They must wake up and join the advancing march, or be left behind.

In closing I would simply say, General Butler's address before the Worcester society, as a means of enlightenment on important subjects, was worth more to the agricultural interest than half a dozen commonplace reports. In the language of another, "read and heed its suggestions; and would that it could be placed on the desk of every member of the legislature."

IMLA K. BROWN.

HAMPDEN EAST.

The farmer's seventeenth annual festival and cattle fair of Hampden East, was held at Palmer October 12. The day was favorable and men, women, and children embraced the opportunity to see what was to be seen, and to hear what was to be heard.

Situated as Palmer is among the fruitful hills and fertile valleys, bordering on the Ware, the Swift, and the Chicopee rivers,—affording facilities for manufacturing, as well as for agricultural interests, and where among the pleasant and tasteful villages within the limits of that Society, agriculture should not be behind the other arts, your delegate to that Society's exhibition, anticipated that in many, if not in most respects it would surpass other similar exhibitions in the State.

With this preparation of mind I left the cars at the railroad station and soon found my way to the fair ground.

And now, Mr. Chairman, what shall I say? The object of this Board, in sending delegates to the various agricultural exhibitions in the State, as I understand, is that you, and through you the State, whose servants we are, may know the standing and progress of the several agricultural societies fostered by its bounty.

With this assumption, if I may be allowed to proceed, I will state things as I found them, and will leave you to judge of the prosperity of the Hampden East Agricultural Society.

The grounds owned by this society, are well located, and ample for all present purposes.

There were twenty-two entries of cattle in the yoke—five milch cows—thirteen two years old heifers, and three fat cattle besides a few bulls, and yearlings.

A pair of three years old steers among the cattle in the yoke,

weighing 3,280 pounds, and owned by J. B. Foster of Monson, were by far the best cattle of that age, on the ground.

Five entries of sheep, and ten of fowls, were made.

Three ox teams and four horse teams were entered for the premium on ploughing.

There were some very good families of swine, which spoke well for their owners. The boar "Prince Albert," an imported animal, was a noble fellow of his kind, and showed that his owner, A. B. Howard, of Belchertown, is looking for improvement.

There were two pairs of work horses, and two stallions on exhibition. The foregoing comprises the stock and fowls on the ground.

The Society have a track on their grounds, but it was not used as a trial ground on that occasion. There were a few implements of husbandry for show, which completed the out-door exhibition of the Society.

I was informed by J. B. Knox, Esq., president of the Society, that there had not been any change in the financial affairs of the Society "since the publication of Mr. Flint's report."

Another exhibition on the ground of the Society, for which the officers may say they are not responsible (but the public will judge), was one which drew by far the greatest crowd, and in which there seemed by far the deepest interest taken by most people present.

It consisted of a score or more of noisy hucksters—dealers in a great variety of small things, abounding in vulgarity, making the air vocal—

> "With sounds unearthly,
> And with songs profane,"

poisoning the mind of youth and grown-up boys, to say nothing of the other sex, and prejudicing the better part of the community against exhibitions designed to promote the public good.

If such has been the practice in former years, no marvel that the interest in the Society has been abating for several years, as I was told had been the case.

Your delegate may be alone in the opinion that such scenes as transpired at Palmer ought not to be allowed by any agricultural society, and should be frowned down by a healthy populace.

Your delegate did not learn that there was any public dinner or public address.

The most pleasing part of the exhibition was in the vestry of the church, the Society having no hall in which to display their fruits,

flowers, vegetables and the products of the dairy, with the sweets and the sours, a general assortment of which was exhibited.

A. H. Murdock, of Palmer, exhibited one hundred and fifty varieties, which for quality as well as quantity spoke well for the interest he took in that part of the exhibition. C. D. Green exhibited twenty, and H. Maxwell twenty-five, varieties.

Others were not backward in their aid to make this part of the show worthy the occasion. There was a good supply of fruit, especially of pears of various kinds, and good specimens of their kind.

Specimens of needle-work and the fine arts filled a large place in the room, and much praise is due to the ladies who permitted an examination of their skill displayed in the wrought pieces on exhibition.

Mrs. Wetmore offered a most superb carriage-robe, which neither the president of that society nor the President of the United States would feel otherwise than honored by the protection of.

A robe, made from the skins of various animals, was exhibited by Mrs. Mary Shaw, of Monson. This robe, though singular in its appearance, displayed good taste in the arraugment of the skins of which it was made.

The butter, cheese and bread, to appearance, was good, and which no doubt, if we had been allowed to taste, we should have pronounced better than may be found in most families.

One very good-looking loaf attracted our attention, and with it was the recipe after which it was made, which was in the following words, viz.: "One gill hop-yeast, a quantity of new milk made thick enough to rise; when raised, add a little more milk, and thicken according to the discretion of the maker, and rise again sufficient to bake;" and there was added, "*This is domestic.*" And your delegate thought it probable that the recipe was also *original.*

The exhibition in the hall was by far the most interesting feature of the day, and showed that spirit and enterprise were not lacking in this department, if it did wane elsewhere.

Your delegate left Palmer with the impression that if what was seen on the fair-ground was a fair specimen of the result of the united ambition of the Agricultural Society of Hampden East, an element of greater power than that which now exists in the Society must be brought into action to ensure prosperity.

THOMAS W. WARD.

UNION.

The annual fair and show of the Union Agricultural Society was held at Blandford, September 28 and 29. The fair day was a cold, windy, uncomfortable one, but did not have the effect to blow away the zeal, or freeze up the ardent desire of the farmers to have their annual gathering a good one.

I understand that this infant legal organization is the offspring of an efficient and influential farmer's club; and, although this Society is young and its present members less than 300, the two days' exhibition would be creditable to one more mature and of larger size.

Some eight surrounding towns contribute mainly to its support. The society have about ten acres of land, partly well fenced, for their show grounds, an exhibition and dining hall, two stories high, with all necessary apparatus for cooking and cookery for the table, and on the grounds a suitable judges' stand; these are all new and occupied for the first time this season. The Society have incurred a debt of about $1,800, but this, instead of proving an embarrassment, may act as an incentive for vigorous action and enlarged effort to increase the interest in the good cause for which they are associated, and to make their annual show more attractive from year to year.

There were on exhibition about 75 pairs of cattle and steers; the neat stock, consisting of cows, heifers, calves and bulls, 45 in number. There were entries of thoroughbred and grade Durham, Devon and Ayrshire; Lewis R. Nye, G. C. Rowley and E. W. Boise were the principal exhibitors of blood stock; the introduction of thoroughbred and grade stock into this town is quite recent, but the future prospect for this kind of stock, judging from what was exhibited, is encouraging.

I was informed that it was quite a practice of the Blandford farmers to raise and purchase young cattle and keep them a few years, and then sell for working oxen,—hence the youthful appearance of the stock. The show of sheep was small, as also that of swine; judging from the exhibition of the latter, we should suppose the people in that locality were direct descendants of Israel. We noticed several varieties of poultry which did credit to their respective breeds. Notwithstanding the unfavorable season in this part of the State for fruit, the show of apples was good; a few pears, but good specimens. I was shown some very beautiful Norway oats, very heavy, weighing one-third more than our common oats;

the owner said he harvested 75 bushels to the acre,—the soil on which they were raised was no better, and as easily cultivated as any other kind. Different varieties and fine samples of potatoes and other vegetables were on exhibition.

I was much pleased with what I am able to credit to the farmers' wives and daughters as one of the best features of the hall, it being in good keeping and eminently appropriate to a farmers' show, in contrast with what has become very common at fairs, viz.: a great display of imported dry goods, &c., from the merchant's shop. I noticed a good assortment of prime, knit-by-hand woollen mittens, gloves and stockings, and many other things useful and necessary for the farmer and his boys; abundant evidence was also given that the girls understand how to manufacture such baits as they deem policy, to accompany their own personal attractions.

Considerable time was taken in testing the strength of cattle by drawing a loaded dray; or, perhaps, it would accord nearer with the fact to say, to see which would win the prize.

Were I to comment on this part of the exhibition, I could not do so with that degree of approbation that I should desire; I consider *that* meritorious which will develop the good training of the oxen and the skill of the driver, with but little whipping or noise.

The second day was the show of horses; but, as I was not present, I can make no report from observation; I am informed, however, that the exhibition was very respectable for that region.

The address of Col. Stone of Dedham, is spoken of as being an able one, and added much to the enjoyment of the last hours of the second day.

I received the polite attention of the officers and others of the Society, for which I thank them.

CHAS. C. BASSETT.

FRANKLIN.

THE twentieth annual exhibition of the Franklin County Agricultural Society occurred at Greenfield on Thursday and Friday, September 30 and October 1, and was in every respect a credit to the farmers, mechanics and manufacturers of this small, but fertile and enterprising county. Both days were beautiful, and after the fogs of the morning were dispelled, the sun shone without interruption on crowds of fair women and brave men, and the largest and best herds of cattle that we have ever known collected at a county fair. There were fourteen herds which numbered in the aggregate three

hundred and fifty, and each animal was worthy of counting one. In all, there were nearly seven hundred cattle on exhibition, many of them thoroughbred, and the grades were so near the perfect standard, that none but a connoisseur could distinguish the difference. We were not aware that little Franklin could make so large and excellent an exhibition. Specimens of all the different herds, from the stately Durhams to the little Jerseys and Kerrys, were exhibited, but the Durhams are evidently the favorite stock of the Franklin farmers, and the finest herds of this large breed were not raised and owned in the Connecticut and Deerfield valleys, but on the high rough hills of Shelburne. The general impression has been that the Durhams could thrive only on the rich pastures and meadows of the lowlands, but our observation on the Berkshire hills has convinced us that no cattle do better on the sweet, short herbage of the mountains than the Durhams, and this conclusion is confirmed by the experience of the Franklin farmers.

So many excellent herds were exhibited at Greenfield, that it may seem invidious to particularize, but we should not do justice to the exhibition, did we not allude to the fine herds of the Messrs. Anderson and Wells of Shelburne, and Mr. Stoughton of Gill. The Messrs. Andersons' herd consisted of twenty-five high grade Durhams, so high that they consider them thoroughbred. A finer herd of animals of their age we never saw, but still we think the Messrs. Anderson have made a mistake in ceasing to breed from thoroughbred bulls. The "Roan Duke" did wonders for the Anderson herd, but another Duke might have led to a still higher strain of blood. The herd of the Messrs. Wells is scarcely, if at all, inferior to their neighbors, the Messrs. Anderson, and the Messrs. Wells are pushing on for higher excellence, under the leadership of "Duke Reginald," a noble specimen of the Durham family, weighing 2,000 pounds. All the Shelburne stock show great weight as well as symmetrical form. Three pairs of yearling steers from the Anderson herd showed an average weight of 2,500 pounds per pair, and the heaviest pair weighed 2,640 pounds. It ought to be stated here, however, that the custom of the Shelburne farmers is to have their cows come in during the autumn, or the fore part of winter, so that their yearlings are nearly two years old at the time of their fair.

These Durham cattle do not run entirely to beef, as some may suppose. The testimony of the farmers was unanimous in favor of their milking properties, and the cows had every appearance of being good milkers. A very large grade Durham cow of M. A. Barnard & Son was on exhibition, which weighed 1,800 pounds, and had furnished sixteen pounds of butter in a week. A two-year-old

heifer, in the herd of Samuel Fisk & Son, weighed 1,410 pounds, and six pairs of steers from the same herd weighed in the aggregate 15,465 pounds, and one pair, three years old, brought down the scales at 3,200 pounds.

The herd of Mr. T. M. Stoughton, of Gill, consisted of forty full-blooded Jerseys. On fourteen of his cows he had placed small silver bells, so selected as to chime, and the harmonious tinkling, as they grazed on the fair grounds, gave additional charms to the exhibition. On the morning of the second day of the Fair, by invitation of Mr. Thomas J. Field, an ex-member of the Board, we rode to Mr. Stoughton's farm to examine his herd more minutely. We found the home, the farm, and the herd, all chiming together as harmoniously as did the bells on the pretty Jerseys that were feeding near by in the meadow. Could Virgil have witnessed this scene, our High School students would have had one more Bucolic to study. We had heard before of the poetry of a farmer's life, but here we heard the music set to the poetry. The sight of a spacious and comfortable farm house, with ample and convenient barns, and forty fawn-like Jerseys grazing in an adjacent meadow, are enough to fill the eye of any farmer; and if in addition to this the tinkling of a chime of bells is constantly sounding in his ear, he will be convinced that farm life is not without its poetry and its music. These little Jerseys give milk of the richest quality; many of Mr. Stoughton's cows furnishing two pounds of butter daily, which commands a price far in advance of the market quotations.

Shelburne furnished for the exhibition a string of fifty-five pairs of oxen and steers, and of these there were forty pairs that averaged 3,770 pounds to the pair, the heaviest, belonging to the brothers Anderson, weighing 4,800 pounds. In the Deerfield string of thirty-two pairs, all heavy and symmetrical, there was one pair owned by the McClellans that weighed 4,985 pounds. These are tall figures, but the cattle were both tall and broad. The whole exhibition was so excellent that we are conscious we cannot do justice to it. To appreciate such a fair it must be seen. We were glad to see a pure cattle show attracting so much attention and enlisting so much enthusiasm and competition. It has been said and believed by some, that our cattle shows must be run by horses to draw the crowd and make them pay, but the grass was growing on the track of the Franklin County grounds, and the cattle, not the horses, were "the observed of all observers."

Dr. J. R. Nichols, editor of "The Journal of Chemistry," gave the address, which was at once scientific and practical, just such as should edify and enlighten all gatherings of farmers.

The exhibition in the hall proved that the farmers had wives who were helpmeets. The tasteful arrangement of their handiwork and of the fruits, flowers, vegetables and specimens of mechanical skill, reflected the highest credit on the ladies who are sovereigns in-doors as men are in the field. 1869 was not a fruit year in Massachusetts, but no one would have thought so, judging from the exhibition. One old associate on the Board, Mr. J. M. Smith of Sunderland, furnished forty-nine plates of different species of fruits, among which were twenty-two varieties of apples, eleven of pears, and eleven of grapes. Grapes were the crowning glory of the fruit tables. There were bunches of Delawares that weighed fourteen ounces, and the Concords, Israellas, and Hartford prolifics were no mean imitations of the clusters of Eschol. We rejoice at this evidence of the success of grape culture in Massachusetts. At the conclusion of the two days' exhibition, we accepted an invitation from Col. Wells, the president, to visit his home in Shelburne and examine the Shelburne herds on their hilly pastures. The visit was one of great pleasure and profit, and we became convinced that it is not necessary for Massachusetts farmers to exchange their rough farms for the prairie, in order to raise good stock and make a home and a competence.

ALEX. HYDE.

HOUSATONIC.

On the 29th and 30th of September last, I attended the twenty-eighth annual cattle show and fair of the Housatonic Society, held at Great Barrington. The weather was truly delightful. The attendance was large, and every thing which goes to make up a first-class cattle show was there in great abundance.

The stock, which consisted mostly of Shorthorns and grades, was displayed in large numbers, and the quality was unexceptionable. A small herd of Jerseys, entered by Mr. Mackie, of Great Barrington, attracted much attention. The neat stock on exhibition numbered about 200. We also counted 60 sheep and 40 swine.

The display in the hall, of fruit, seeds and vegetables was truly excellent, and we were told surpassed that of any former exhibition. Mr. Henry S. Goodale, of Mt. Washington, displayed 130 varieties of potatoes. They were washed clean and arranged in the order of their merit, occupying an entire table. On each variety was written its name, and also its yield per square rod, ascertained by careful experiment. Mr. Goodale was courteous and untiring in answering

the countless inquiries in relation to the origin, quality, yield, and comparative value of his different varieties. We were told that he makes the raising of potatoes a specialty, and for this display he is certainly entitled to great credit. This Society is in a flourishing condition. It numbers 1,300, is out of debt, has commodious grounds and buildings, and is perhaps doing as much to develop its agricultural resources and to stimulate production, as any society in the State. The competition among farmers for the growth of crops, is very liberally and we think very properly encouraged. During the year 1868, there were 123 summer crops and 196 fall crops entered for premiums, all of which were examined and reported on by the committee appointed for that purpose. This indicates to some extent, the spirit which animates the farmers of Southern Berkshire. Would it not be well for other societies to increase the number and amount of their premiums for superior crops, even though it should sensibly lighten the purse, reserved for the "fastest horse in or out of the county."

During our visit we were the guest of T. D. Thacher, Esq., a member of this Board, and to him we are indebted for the rare pleasure of a ride in an open carriage some forty-five miles in the charming valley of the Housatonic. The numerous thriving villages found at every cascade on the river, connected by smooth, hard roads and substantial bridges, the even surface of the valley carpeted with a dark rich verdure, the numerous large, well filled barns and opulent dwellings of the farmers, the pure bracing air and clear cold streams gushing from the hills, the beauty and grandeur of her mountain scenery, heightened by the early autumnal tints, truly and justly declare the glory of old Berkshire. Her fame is no longer a mystery.

A. P. Slade.

NORFOLK.

On Thursday and Friday, Sept. 23d and 24th, 1869, the Norfolk Agricultural Society held its twenty-first annual exhibition on its new grounds at Readville. The weather was delightful both days, and it was considered the most successful show ever held by that Society. It seems scarce a day ago since the plain of Readville was all alive with the tramp of our brave brothers and sons; even the surrounding hills were made to echo with the sound of the war bugle and the drum. But the sorrow and darkness which then overshadowed our land has been dispelled, peace restored, and we

can now, through the providence of God, and the blood of our brave and gallant sons, boast of the greatest boon to a people—Freedom. We return to Readville not to hear the tramp of camp life, but rather the lowing, neighing, bleating, and cackling of our domestic animals.

On arriving at the fair grounds we were met by the Society's representative, Colonel Stone, who was untiring in his attentions during our visit. May the blessing of God attend him and his.

The Society bought and moved on to the east line of its ground several of the old barracks, which had been used on the old camp ground and fitted them up, some for show rooms for the exhibition of the different articles and products presented; others are used for stabling and stalls for horses on exhibition. Probably no society in the State has as good an arrangement for show rooms and stabling. The Society have built a very fine half mile track, which is used principally for the trial of horse speed; connected with the track is the judges' stand and the grand stand opposite.

The horse department was divided into five classes—these classes into several divisions. Class A, roadsters, consisted of five divisions; in this class there were nineteen entries. Class B, horses of all work, eighteen entries were made. Class C, family horses, twenty-four entries reported in this class. Class D, draught or team horses; this class consisted of ten entries, all of which were very attractive. The fifth class was made up of trotters, or sporting horses. The celebrated trotting horse, Garibaldi, passed around the half-mile track in 1.18. The collection of stock was large and well represented in all the departments. The most noticeable amongst the bulls was the imported Jersey "Jack Horner," owned by W. M. Mack, of Dorchester; the Ayrshire owned by J. W. Gay, of Dedham; and the Alderneys of Hon. J. S. Eldridge, president of the Society. Your delegate was not a little surprised to learn that the Norfolk Society still continue to offer premiums for grade bulls; in this respect Norfolk is behind. We should always breed from pure-bred males; in this way we breed strength; with grade, weakness. Mr. Eldridge exhibited a herd of Jerseys, thirty in number; in this herd were some of the finest Jersey heifers I have ever seen. To this herd was awarded the first premium, the *Wilder Cup*.

The show of stock was very creditable being represented by fine specimens of each of the different breeds, although the unmistakable marks of that grade bull are seen in too many instances.

The collection of swine was very fine. Mr. John Sias, of Milton, exhibited a Mackay sow, four years old, which has had one hundred and three pigs; other fine specimens were also exhibited.

Most conspicuous in the show of poultry, were the Cochins from C. L. Copland of Milton; fine specimens of other varieties were on exhibition. Your delegate was not in season to witness the ploughing match, but was informed that the ploughmen showed good skill in the performance. The teams that competed for the prizes in the department of drawing and backing showed good training. The ladies made a very fine display of the useful, as well as the ornamental, in their particular department—the most noticeable was a beautiful affghan, about six feet square, with a raised figure of a horse worked upon it, by Miss Nellie Thomas, of Dedham.

The department of fruit was not as large as usual on account of the apple crop having been blown from the trees in the great gale of the 8th inst., yet a very good show was made. Hon. M. P. Wilder exhibited one hundred and eight varieties of pears; and many other gentlemen made fine contributions. Seventy plates of grapes were shown, representing all the leading varieties by very fine specimens of each. Fine displays in the floral department were made by Geo. Craft, Mrs. Stewart, Mrs. Vose, and others. The show of vegetables was very large and of superior quality, giving evidence that the farmers of Norfolk take a commendable interest in this most valuable crop. The show of bread and the dairy product was rather small, but of good quality. Some good seed corn was exhibited.

The show of agricultural implements was quite extensive, made principally by Parker & Gannett of Boston. The Society's prize diploma was awarded to Shamrock & Cooper, for new and improved parlor and cook stove.

The cavalcade upon the track was led by the chief marshal, and preceded by the Canton brass band, which played a quick-step, "The Norfolk March," composed by the accomplished leader, E. A. Samuels, and dedicated to the Society. At about twelve o'clock, M., a large procession was formed, and marched under the direction of the chief marshal to a large tent, where a splendid collation had been prepared. After prayer had been offered, the president invited the company to partake of the repast. At the conclusion of the dinner, the president made an appropriate address of welcome. The regular annual address was made by Dr. George B. Loring; it was one of his ablest productions and was listened to with the closest attention to the close.

Dr. Loring is one of the soundest writers and finest orators of the age, and no man has done more to advance the interest of agriculture in our own Commonwealth.

Your delegate would acknowledge the courtesy and attention extended by the officers of the Society and many others.

JOHN JOHNSON, JR.

FRAMINGHAM, January 26, 1870.

BRISTOL CENTRAL.

This exhibition was held the 23d, 24th and 25th of September. The weather was such as to inspire all those interested in the exhibition, and such a collection of people is rarely seen at our cattle shows.

The attention of your delegate was first directed to the ploughing match, where horses and oxen displayed their training, and their drivers showed their skill in turning up the green sward. They labored under the difficulty of having wet ground and a poor and weak sward. The teams were prompt, and the work as well done as could be expected in such ground. My own, and the interest of others, was drawn to the trial of the strength of the various teams. There was a novel feature here. Instead of pushing or drawing the load up an *abrupt inclined plane*, they had blocks of stone thrown under the wheels. This seemed to impede the lighter cattle more in proportion than the heavier ones, but tested well the evenness of matching. But we confess that both horses and oxen not only showed great muscular power, but a skill in using it, and a courage which reflect great credit on the intelligence, humanity and care of their owners or drivers.

The procession of twenty pairs of finely matched work-horses from Fall River; thirty-one pairs of oxen and steers from Taunton; and twenty-five from Lakeville, with other fine teams, made a grand display, and had an amusing feature added, of a pair of fine heifers attached to a wagon and driven by their owner like horses. From this my attention was turned to the stock on exhibition, and I feel the show of breeding mares and colts was worthy of the attention of any persons interested in speed, endurance and action of the horse. The carriage horses and matched teams exhibited a richness of blood and careful breeding, that leads us to feel that the exhibitors are honoring our State by their selection and breeding, as well as making their own exhibition so creditable.

The fat oxen were also remarkable for size and weight. Some pairs weighed as high as five thousand pounds each.

The working oxen were not numerous nor large sized, but gener-

ally well matched and bred. The Devons seemed to be the finest among them.

There were exhibited two as fine bred and perfect Jersey bulls, as I have seen anywhere. The cows and heifers of this blood also showed the great attention of their breeders. Then a few Ayrshires, and grades of various bloods indicate that the people in this region are alive to the improvement of the neat stock. We must say, however, that the show of stock seemed small. A few fine specimens of swine were on the ground. Two breeding sows, one nine years old had brought 285 pigs; and another six years old had presented her owner with 156 pigs.

The show of poultry was very large. We imagine that every breed must have been summoned to show their fine points, by the appearance, and it is rare to find a finer display of birds.

Everywhere we encountered a crowd of people. This was especially the case in the halls where the large agricultural products, cereals and vegetables were exhibited. The most worthy of especial notice were the white field corn and white wheat, and a very numerous variety of potatoes, showing us that the farmers are looking to new seed for something to keep the important crop up to its full yield, in both quantity and quality.

The dairy also was represented in golden butter and a few cheeses, that must lead the agriculturists to see that this important staple of our farms received due attention. Added to this the manufacturers and mechanics presented every variety of machinery and products, which not only graced the exhibition and gave you the assurance of such united interest of producers in this vicinity, but will make the future of this region to show wonderful progress in wealth, and success in every department of labor.

The most gorgeous and beautiful display was found in the upper hall of their fine building. Here the eye feasted on plants of every kind,—cut flowers, peach, orange and fig-trees, in full bearing; with the luscious clusters of eight varieties of grapes, forty-four of pears, and thirty-eight of apples, all of which were contributed by the president. In the same line, though not as extensive, yet most beautiful, was the display of J. M. Godfrey, of Lakeville.

Considering the heavy gale which had swept over this region, we think the exhibition of fruit larger and finer than could have been expected. The beautiful prints and silesias and woollen goods, with some choice specimens of art shown here, all made a picture rich in prophecy, as well as in attainment.

On the second day there was a real trial of speed of some of the thoroughbred horses of this neighborhood, that had none of the

humbug of the race course. There was also a display of the action and style of carriage horses, single and matched, showing speed, training and breeding, seldom outdone.

In the procession and exhibition of the premium stock, with their gaudy colors; in the announcement of the premium of each by the chairman of the several committees from the stand, and in the quiet ease and pride of exhibitors, as they passed around the track, there was a feature which added much to the interest of the exhibition and seemed worthy of note. All this was crowned with the hearty congratulations of the president, upon the success of their show, and a witty address from Charles T. Russell, of Cambridge.

We think this Society in a very prosperous condition, and much of its success is due to the great exertions of the president, Dr. Durfee, whose attention and politeness to delegates from this Board are *proverbial.*

I refer to his efforts in this Society, to show what one man can do, and what we may expect when men of wealth, leisure and intelligence give their heart to further any great interest, and especially that of agriculture. He will find all our farmers ready to respond to his efforts.

William Knowlton.

HINGHAM.

The Hingham Agricultural and Horticultural Society held its eleventh annual exhibition September 28th and 29th. The weather was all that could be desired for such an occasion.

The people were out in full numbers and were inspired with a certain degree of enthusiasm essential to insure success and make a society useful and profitable to the community of which it is composed.

The success and general character of an agricultural society will tell a truthful story in regard to the enterprise and thrift of its district.

This Society have a large and beautiful building with a basement. In this basement is a kitchen finished and furnished with all the modern improvements for cooking. Here the Society's dinners are prepared and by means of an elevator are carried to the dining hall which is located on the second floor, and is large enough to seat one thousand people. Above is another large hall not yet finished.

The grounds are not enclosed by a high board-fence as most grounds used for agricultural exhibitions are. The people of that

county having always been renowned for conscientious scruples is a sufficient reason. On arriving at the depot I was welcomed by the president, Hon. Albert Fearing. After a few moments very pleasantly spent at his house and grounds we were invited to a seat in his carriage and were soon moving rapidly towards the fair grounds. On our way the old church was pointed out to me as dating back to 1681, and still looks as good as new. When we arrived at the new library building (which by the way was built, furnished, and five thousand dollars' worth of books presented to the town by the Hon. Mr. Fearing the whole cost being about twenty thousand dollars; this is one of Mr. Fearing's pets,) we met the town team composed of 40 pairs of oxen; some gentlemen estimated the weight per pair to average as high as 3,000 pounds. It was the best collection of oxen I ever saw together; they were an honor to any farming community.

Arriving at the exhibition hall and after the usual introductions we commenced our examinations of the large and almost bewildering collection of articles, &c. No department seemed at all neglected, although the great blow of September 8th destroyed a large proportion of the apple crop; still this department was well represented by good specimens of the different varieties. The show of grapes was very large and each variety was of superior quality.

A very good collection of bread, honey, butter and cheese, was on exhibition.

The show of vegetables was very large and of excellent quality. A few very handsome specimens of peaches were exhibited by Sarah D. Fisk. The show of pears was also very commendable.

Almost an innumerable number and variety of fancy articles were on exhibition.

The stock department was well represented by fine specimens of each of the different importations. The appearance of the native cows was highly commendable.

About 250 sheep were on exhibition and many of them of superior quality. It is very evident that in this district considerable attention is paid to sheep husbandry. The show of swine was also excellent. Too much attention cannot be given to the breeding of swine; every farmer should raise his own as far as possible.

Your delegate did not witness the ploughing match, but was informed that the work was done in a skilful manner.

The trial of working oxen was very interesting and called together a large crowd of people.

The exhibition of horses was not very attractive not having a suitable place for them to show their beauty and power.

At about half past twelve o'clock a procession was formed and marched to the dining hall to partake of a most bountiful repast. After prayer was offered and dinner served, the president made a very fine address of welcome and congratulation. Your delegate would acknowledge the kind attentions of the president and officers of the Society.

JOHN JOHNSON, Jr.

FRAMINGHAM, January 26, 1870.

MARSHFIELD.

As delegate from this Board, I attended the Marshfield Agricultural Society's Exhibition held on the 7th, 8th and 9th of October, 1869. The first day was devoted mostly to the reception and arranging of stock on the grounds, and the various articles in the hall and basement of what is to be a nice building for exhibition and dining purposes, and for public speaking. The ploughing match was in the forenoon (1st day). In the afternoon the trial of oxen on draft, was very good. The exhibition in the hall was good, although very much more room would have shown them at a better advantage. There was a large collection of apples, compared with other societies, and the crop of this season. Pears, peaches, grapes and other fruits were excellent. The vegetables were large and the potatoes splendid. Corn and other grains that were on exhibition would compare favorably with any other part of the State. There were mowing machines, horse rakes, and hay-tedders, wagons for business, and pleasure, and a variety of other implements for the farmer and others that are very useful.

The second day the crowd of people was larger than the first; the exhibition of town teams was one of the best that I have ever seen,—one hundred and forty yoke of oxen nearly enclosing the half mile track, nearly all good size and well matched. The cows were not large in size nor in number, as the farmers understand in that section that the soil is better adapted to a medium size and hardy stock, as the Shorthorn do not thrive as well there. Sheep and swine but few entered; the fat hogs were large and nice. There was one large and nice flock of geese, thirty-six, including the mother, that attracted much attention. Other fowls that were good were on exhibition. The Society's dinners were provided on the second and third days in a large tent, and well filled.

After dinner, speeches by the president of the society, clergy, and members from other agricultural societies, the speaker engaged for the occasion not being present.

A show of good horses and carriages in the afternoon on the track attracted much attention.

A concert in the tent in the evening by the band was well attended and netted the Society a good sum of money.

The third day was devoted mostly to the show of horses and colts. The attendance and exhibition of horses and carriages on the track was such that the ladies were particularly attracted, although there was not that racing that is seen on the track of some of our societies. The complete arrangements of the officers of the Society with the police were worthy of much praise; not a drunkard or disorderly person was noticed by your delegate during the show.

Much credit is due the Society in the zeal and effort they have manifested by the increase of members this season, from 400 to over 800. While their building for agricultural purposes was half completed, it was entirely demolished in the early part of the fall by the wind. They have made arrangements for rebuilding before another season a substantial agricultural hall. With much satisfaction for kind attention and hospitality we shall ever remember with pleasure the officers and members of this Society.

J. S. Blair.

MARTHA'S VINEYARD.

The twelfth annual fair of the Martha's Vineyard Agricultural Society, was held at West Tisbury, October 19th, 20th, and 21st. On my way I fell in company, at New Bedford, with our worthy Secretary, who was also on his way to the island to deliver an address before the Society. When we landed at Holmes' Hole, we found the secretary, David Mayhew, Esq., in readiness to take us immediately to West Tisbury, the centre of attraction for the week. The day was nearly spent before we arrived on the ground, and as it was a cold day, with a drizzling rain, we were disappointed at finding so large a collection of people, and so many animals for exhibition.

There were one hundred and eighty head of cattle, among them many thoroughbred and grade Ayrshires. And here let me say that we occasionally hear the remark that "agricultural societies and fairs amount to nothing, or very little." But this, I think, usually comes from those who, like the Chinese, are willing to have things remain stationary. But if any one will visit this island, attend one of their exhibitions, learn the condition of agriculture

twelve years since, trace its improvement to the present time, and its probable success for the future, they will find something has been done, yea much. Then let them ask themselves what has occasioned this change, if not that the attention of the people has been called more directly to the subject by the establishment of agricultural societies, and their annual exhibitions.

Many much larger societies will not show as large a collection of neat stock. Ayrshires were introduced here a few years since, and from the reports of those who have them, we should judge they were a decided improvement, and that this island was very favorable for their introduction and improvement. There were fifty-eight sheep; a larger number than are usually seen at any of our fairs. In this as in other departments, it shows that the people are alive to the best interests of the Society. Swine were not seen in large numbers, and I think only three premiums were awarded. Geese, ducks, turkeys and chickens were not forgotten, and received their share of attention.

We next visited the hall, and as we had been told that "barrenness was the rule, and fertility the exception on this island," we were surprised at finding so large a collection in this department of the show. A better collection is seldom seen, or at least, I have seldom seen one, so that the fertile spots must be exceedingly productive. Potatoes, squashes, pumpkins, melons, turnips, beets, carrots, parsnips, cabbages, onions, beans, corn, wheat, rye, oats, barley, buckwheat, apples, pears, peaches, grapes, quinces, tomatoes, peppers, flowers, bread of various kinds, cakes, butter, cheese, preserves, and honey were seen in abundance, and did credit to the various contributors. Squashes, although not as large as one shown by G. S. Allen of the Worcester South, which weighed 204 pounds, yet large enough to satisfy any reasonable squash grower. Suffice it to say, the show here was excellent. In the fancy and miscellaneous department the show was full, and discovered the skill and handiwork of the ladies, and the interest they also manifest in these yearly gatherings.

My attention was called to the quince and cranberry crop, both of which flourish remarkably well upon this island. The latter is receiving increasing attention, and is found to be very remunerative. This shows the tact of the Yankee to adapt himself to circumstances, and ascertain what crop is best adapted to his particular locality.

The ploughing match came off before we arrived, but I was told there was but little interest manifested, as there was only one team to plough. This is a very important part of farm work, as good

ploughing is the foundation of good cultivation, and a healthy competion in all departments is essential to good success.

The second day was devoted to horses; and as the president and secretary invited Mr. Flint and myself to visit different parts of the island, that we might get a better knowledge of its agricultural interests, we readily accepted the invitation. On passing through Chilmark the crops of corn, mowing and pasture land, indicated a better soil and much more productive. Our attention was especially called to some very fine fields of corn that would compare favorably with any part of the State. From Chilmark we proceeded to Gay Head, the western extremity of the island, which is occupied by a remnant of a tribe of Indians, about 250 in number, who appear to be industrious, and so far as we saw, intelligent and happy. We were told that they were about to ask the legislature for an Act of incorporation as a town, with all the rights and privileges of citizens. If this is granted, it will probably stimulate them to renewed industry in their agricultural pursuits.

We inquired, on the evening of the second day, if the people would come out in as large numbers the third day (for they held their fair three days), and were told that they probably would, as that was their custom. We found it to be true; for when the hour arrived for the address, the hall was crowded, and the address of our worthy Secretary, C. L. Flint, Esq., upon the importance of concentrated labor upon the farm, was listened to with marked attention. Shorter speeches followed until the final adjournment. We left the place with many pleasant remembrances of our visit to this beautiful island.

We found a very cordial welcome by the people; and our thanks are especially due to the family where we found so pleasant a home, to the president, Herman Vincent, Esq., to the secretary, David Mayhew, Esq., to H. L. Whiting, Esq., and to Dr. D. A Cleveland, for their kind attentions; also for giving us so extended a view of the island.

NEWTON S. HUBBARD.

FINANCES OF THE SOCIETIES.

SOCIETIES.	Amount receiv'd from the Commonwealth.	Income fr'm permanent fund.	New members & donations.	All other sources.	Receipts for the year.	Prems. offered.	Prem's and gratuities paid.	Current expen's for the year—not including premiums and gratuities.	Disbursem'ts for the year.	Indebtedness.	Value of real estate.	Value of personal property.	Permanent fund.
Massachusetts,	-	$4,026 00	-	$1,217 55	$5,243 55	$1,950 00	$450 00	$4,238 97	$4,688 97	-	-	-	-
Essex,	$600 00	1,041 85	$284 00	368 00	2,294 00	2,040 00	1,011 00	791 91	1,802 91	-	$6,000 00	$13,380 10	$13,380 10
Middlesex,	600 00	-	4,271 00	3,251 39	8,122 39	1,765 00	1,416 00	1,958 92	3,374 92	$8,000 00	25,000 00	1,000 00	11,000 00
Middlesex North,	600 00	-	156 00	4,460 74	5,216 74	554 00	327 25	1,170 98	3,547 53	3,000 00	9,147 54	805 69	6,953 23
Middlesex South,	600 00	-	510 10	3,800 92	4,911 02	2,339 00	1,158 25	1,580 93	2,738 18	12,500 00	15,000 00	1,050 00	3,550 00
Worcester,	600 00	-	210 00	6,172 09	6,982 09	2,198 25	2,031 75	2,102 81	7,041 01	29,000 00	60,000 00	1,000 00	15,000 00
Worcester West,	600 00	200 00	42 00	2,372 25	3,214 35	1,840 75	1,158 50	1,195 38	3,280 39	5,291 77	14,450 00	724 62	9,158 00
Worcester North,	600 00	-	110 00	2,866 09	3,576 09	2,309 75	1,529 25	3,028 93	4,558 18	7,000 00	16,000 00	850 00	9,850 00
Worcester N. West,	345 22	-	975 00	9,124 75	10,444 97	957 50	671 40	711 40	10,564 50	12,500 00	14,300 00	1,600 00	3,400 00
Worcester South,	600 00	3,152 19	345 00	2,730 89	6,828 08	1,139 00	756 52	1,847 78	6,589 43	9,000 00	12,505 30	1,450 59	4,955 89
Worcester S. East,	600 00	-	115 00	831 30	1,546 30	1,418 25	723 25	1,155 05	1,878 30	4,500 00	8,500 00	1,000 00	5,000 00
Hampshire, Hampden & Franklin,	600 00	111 76	97 00	2,116 47	2,925 23	987 75	624 83	1,981 12	3,156 95	-	8,000 00	500 00	8,500 00
Hampshire,	600 00	720 25	82 00	30 00	1,432 25	1,050 50	604 12	520 46	-	400 00	5,900 00	550 00	5,900 00
Highland,	600 00	56 15	72 00	418 15	1,146 30	837 25	647 00	540 66	1,146 30	41 41	3,000 00	1,800 00	4,800 00
Hampden East,	600 00	165 00	47 00	-	850 37	1,187 50	300 00	186 83	866 55	1,010 95	7,000 00	300 00	4,500 00
Hampden,	600 00	-	10 00	6,785 64	7,395 64	1,483 75	193 50	5,277 95	5,471 45	23,400 00	35,000 00	-	11,600 00
Union,	388 65	-	312 65	2,495 24	3,196 54	405 75	196 75	2,927 81	3,124 56	1,800 00	4,125 00	322 23	2,647 23

Franklin, . .	$600 00	$150 00	$336 00	$1,321 65	$2,407 65	$1,344 00	$873 83	$935 46	$1,981 70	-	$7,000 00	$1,250 00	$8,250 00
Housatonic, . .	600 00	-	197 00	3,902 68	4,699 68	2,585 00	2,132 00	2,945 92	4,518 13	-	8,000 00	50 00	8,000 00
Berkshire, . .	600 00	350 00	215 00	2,342 30	3,507 30	2,970 00	2,399 50	1,719 42	4,118 92	-	12,000 00	2,500 00	14,500 00
Hoosac Valley, .	600 00	150 00	320 00	1,331 72	2,401 72	1,463 00	1,220 00	868 88	2,088 88	$4,200 00	8,000 00	545 00	4,400 00
Norfolk, . . .	600 00	-	1,005 00	4,268 70	5,873 70	2,710 00	1,071 00	2,976 18	4,047 18	17,000 00	30,000 00	300 00	13,300 00
Bristol, . . .	600 00	-	691 00	9,271 67	10,570 67	-	1,779 75	4,332 35	10,098 80	5,000 00	28,447 39	300 00	23,447 39
Bristol Central, .	600 00	-	169 00	5,111 94	5,880 94	3,409 25	2,559 85	4,736 75	7,296 60	6,300 00	18,000 00	500 00	11,700 00
Plymouth, . .	600 00	259 72	425 00	6,586 76	7,279 68	2,270 50	1,862 35	4,869 45	6,731 80	-	22,000 00	3,750 00	25,750 00
Marshfield, . .	600 00	-	1,847 50	5,970 34	8,417 84	1,000 00	418 61	1,232 62	6,699 19	2,766 83	3,009 65	599 92	4,275 54
Hingham, . .	600 00	-	647 00	3,196 76	4,443 76	1,695 42	995 04	4,543 05	5,338 09	7,000 00	29,680 59	3,431 05	22,680 59
Barnstable, . .	600 00	31 00	135 00	-	1,724 00	716 00	454 00	1,156 00	1,610 00	1,000 00	6,000 00	200 00	5,200 00
Nantucket, . .	600 00	269 48	26 00	173 75	1,069 23	901 00	559 00	420 27	979 27	-	3,500 00	450 00	3,950 00
Martha's Vineyard,	600 00	760 06	298 88	86 00	1,645 03	832 25	609 90	752 72	1,643 02	50 00	3,477 00	3,100 62	6,577 62
Totals, . .	$16,933 87	$11,453 46	$13,951 13	$92,905 65	$135,245 11	$46,360 72	$30,734 00	$62,610 60	$120,981 31	$110,760 96	$423,042 47	$43,309 82	$272,225 59

PERMANENT FUND—HOW INVESTED.

MASSACHUSETTS.—In U. S. bonds, City of Boston bonds, banks, and Mass. Hospital Life Insurance Company.
ESSEX.—In bank stocks, U. S. and Railroad bonds, library, and cash.
MIDDLESEX.—In agricultural hall, land, &c.
MIDDLESEX NORTH.—In land, buildings, and personal property.
MIDDLESEX SOUTH.—In grounds, building, fixtures, &c.
WORCESTER.—In real estate.
WORCESTER WEST.—In real estate and fixtures.
WORCESTER NORTH.—In grounds, fixtures and cash.
WORCESTER NORTH-WEST.—In grounds and buildings occupied by the Society, fixtures, &c.
WORCESTER SOUTH.—In land, hall and track, fixtures, &c.
WORCESTER SOUTH-EAST.—In real estate, hall, fixtures, &c.
HAMPSHIRE, FRANKLIN AND HAMPDEN.—In real estate and personal property.
HAMPSHIRE.—In hall and grounds.
HIGHLAND.—In deposit in savings bank, U. S. bonds, and mortgage on real estate.
HAMPDEN.—In real estate.
HAMPDEN EAST.—In real estate, cattle pens and fixtures.
UNION.—In real estate and personal property.
FRANKLIN.—In bank stock, deposit in savings bank, and real estate.
HOUSATONIC.—In real estate and notes.
BERKSHIRE.—In real estate.
HOOSAC VALLEY.—In real estate.
NORFOLK.—In real estate occupied by the Society.
BRISTOL.—In real estate.
BRISTOL CENTRAL.—In real estate.
PLYMOUTH.—In real estate, furniture, U. S. bonds, notes and cash.
HINGHAM.—In hall and grounds, &c.
BARNSTABLE.—In real estate.
NANTUCKET.—In real estate, bonds, fixtures, &c.
MARTHA'S VINEYARD.—In real estate and secured notes.
MARSHFIELD.—In real estate, deposit in savings bank.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

FARMS.

SOCIETIES.	For managem't of farms.	For experiments in draining.	For subsoiling.	For ploughing at exhibition.	For reclaiming swamp lands.	For experim'ts with manures.	For spading.	For hedges and ornamental trees.	For reclaiming old pastures.	For orchards of all kinds.	For cranberries.	For other farm improvements.	Total amount offered for farm improvements.	Total am't awarded for farm improvements.	Total am't actually paid for farm improvements.
Massachusetts,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex,	$30 00	-	-	$141 00	-	-	-	-	$15 00	-	-	-	$351 00	$186 00	$186 00
Middlesex,	-	-	-	74 00	-	-	-	-	-	-	-	-	287 00	74 00	74 00
Middlesex North,	-	-	-	16 00	-	-	-	-	-	-	$5 00	-	-	-	-
Middlesex South,	-	-	-	102 00	$10 00	-	-	-	-	$7 00	-	-	238 00	119 00	119 00
Worcester,	-	-	-	76 67	-	-	-	-	-	-	-	-	60 00	76 67	76 67
Worcester West,	-	-	-	45 00	-	-	-	-	-	-	-	-	123 00	45 00	45 00
Worcester North,	-	-	-	63 00	-	-	-	-	-	-	-	-	288 00	63 00	63 00
Worcester North-West,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worcester South,	-	-	-	55 00	-	-	-	-	-	-	2 25	-	157 25	57 25	-
Worcester South-East,	-	-	-	119 00	8 00	-	-	-	-	7 00	-	-	226 00	134 00	131 00
Hamps. Franklin & Hampd.	-	-	-	-	-	-	-	-	-	-	-	-	20 00	-	-
Hampshire,	-	-	-	-	-	-	-	-	-	9 00	-	-	36 00	-	-
Highland,	-	-	-	-	-	-	-	-	-	6 00	-	-	33 00	6 00	6 00
Hampden,	-	-	-	-	-	-	-	-	-	-	-	-	102 00	-	-

Hampden East,	-	-	-	$22 00	-	-	-	-	-	-	$00 50	-	$152 50	$22 50	$22 50
Union,	-	-	-	-	-	-	-	-	-	-	-	-	10 00	-	-
Franklin,	-	-	-	-	-	-	-	-	-	-	-	-	35 00	-	-
Housatonic,	$30 00	-	-	26 00	$35 00	-	-	-	-	28 00	3 00	$18 00	169 00	140 00	140 00
Berkshire,	50 00	-	-	50 00	-	-	-	-	-	29 00	-	-	146 00	129 00	129 00
Hoosac Valley,	-	$11 00	-	-	-	$14 00	-	-	-	75 00	-	-	56 00	40 00	40 00
Norfolk,	-	-	-	58 00	-	-	-	-	-	-	-	-	363 00	58 00	50 00
Bristol,	-	-	-	97 00	-	-	-	-	-	-	-	-	227 00	97 00	-
Bristol Central,	-	-	-	59 00	-	-	-	-	-	-	7 00	-	111 00	66 00	66 00
Plymouth,	-	-	-	48 00	-	-	-	-	-	10 00	-	-	68 00	58 00	58 00
Marshfield,	-	-	-	15 00	-	-	-	-	-	-	7 00		152 76	22 00	18 76
Hingham,	-	-	-	41 00	-	-	$7 50	-	-	-	-	-	202 32	48 50	48 50
Barnstable,	15 00	-	-	15 00	-	-	-	-	-	-	3 00	-	33 00	15 00	33 00
Nantucket,	-	-	-	12 00	-	10 00	-	-	-	-	-	-	86 00	22 00	22 00
Martha's Vineyard,	-	-	-	5 00	-	4 00	-	-	-	-	6 75	-	55 00	15 75	15 75
Totals,	$125 00	$11 00	-	$1,139 67	$53 00	$28 00	$7 50	-	$15 00	$171 00	$34 50	$18 00	$3,786 83	$1,494 67	$1,344 18

Analysis of Premiums and Gratuities Awarded—Continued.

FARM STOCK.

SOCIETIES.	For Bulls.	For Milch Cows.	For Heifers.	For Calves.	For Working Oxen.	For Steers.	For Fat Cattle.	For Horses.	For Sheep.	For Swine.	For Poultry.	All other Stock.	Total amount offered for Live Stock.	Total amount awarded for Live Stock.	Total amount paid out for Live Stock.
Massachusetts, . .	-	-	-	-	-	-	-	$450 00	-	-	-	-	$450 00	$450 00	$456 00
Essex, ...	$40 00	$30 00	$24 00	$6 00	$43 00	$30 00	$23 00	167 00	$22 00	$34 00	$20 00	-	560 00	440 00	418 00
Middlesex, . . .	40 00	88 00	38 00	17 00	23 00	-	24 00	189 00	25 00	63 00	82 00	$75 00	777 00	664 00	664 00
Middlesex North, . .	24 50	30 50	17 00	-	11 00	9 00	11 00	32 00	6 00	18 00	12 00	-	278 00	173 00	183 00
Middlesex South, . .	10 00	39 00	22 00	13 00	26 00	-	-	626 00	19 00	35 00	40 00	35 00*	1,110 00	865 00	565 00
Worcester, . . .	120 00	242 00	78 00	23 00	93 00	69 00	26 00	972 00	41 00	42 00	18 00	-	1,779 00	1,724 00	1,724 00
Worcester West, . .	37 00	78 00	21 00	26 00	56 00	43 00	47 00	643 00	20 00	29 00	18 00	58 00	1,349 00	1,076 00	888 00
Worcester North, . .	53 00	52 00	91 00	80 00	40 00	36 00	22 00	698 00	16 00	43 00	12 00	76 00	1,360 00	1,219 00	1,095 00
Worcester North-West,	32 00	26 00	25 00	14 00	27 00	25 00	18 00	351 00	23 00	23 00	10 00	25 00*	734 00	597 00	546 00
Worcester South, . .	36 00	36 00	36 00	24 00	54 00	59 00	7 00	187 00	11 00	31 00	8 50	33 00	670 50	522 50	522 50
Worcester South-East,	30 00	23 00	17 00	7 00	55 00	35 00	11 00	107 00	10 00	39 00	8 00	64 00	523 00	406 00	330 00
Hampshire, Franklin & Hampden, . . .	59 00	35 00	12 00	6 00	81 00	28 00	51 00	219 00	17 00	24 00	15 00	131 00	720 50	678 00	502 58
Hampshire, . . .	22 00	25 00	11 00	19 00	38 00	30 00	17 00	68 00	26 00	28 00	10 00	25 00*	480 00	478 00	459 00
Highland, . . .	30 00	21 00	20 00	5 75	34 00	22 50	15 00	140 00	64 00	6 00	3 00	45 00	534 25	446 25	446 25

Hampden,	$8 00	$12 00	$8 00	$5 00	$45 00	$29 00	-	$57 00	$13 00	$10 00	$13 00	$26 00	$647 50	$226 00	$165 25
Hampden East,	30 00	24 00	36 00	2 00	41 00	33 00	$10 00	58 00	10 00	23 00	14 00	31 00	584 00	312 00	-
Union,	15 00	3 50	9 50	3 00	29 00	10 50	7 00	71 50	4 50	8 00	3 00	14 00	213 00	181 50	170 00
Franklin,	36 00	92 00	16 00	13 00	44 00	41 00	21 00	184 00	58 00	27 00	14 00	82 00	843 00	628 00	612 50
Housatonic,	44 00	83 00	37 00	15 00	77 00	46 00	30 00	306 00	94 00	32 00	40 00	44 00	804 00	733 00	733 00
Berkshire,	82 00	67 00	44 00	23 00	36 00	41 00	26 00	411 00	89 00	36 00	46 00	112 00	1,284 00	1,013 00	1,013 00
Hoosac Valley,	32 00	10 00	15 00	6 00	20 00	15 00	-	156 00	83 00	15 00	30 00	-	590 00	382 00	382 00
Norfolk,	24 00	41 00	10 00	-	12 00	-	-	927 00	-	41 00	13 00	-	1,265 00	1,068 00	760 00
Bristol,	64 00	28 00	48 00	8 00	115 00	57 00	65 00	109 00	28 00	49 00	46 00	-	625 00	617 00	-
Bristol Central,	67 00	135 00	45 00	3 00	141 00	23 00	36 00	1,167 10	34 00	68 00	105 00	-	2,297 00	1,821 10	1,821 10
Plymouth,	70 00	86 00	43 60	39 00	52 00	22 00	54 00	680 00	17 00	43 00	50 00	12 00	1,396 60	1,168 60	1,168 60
Marshfield,	4 00	25 00	18 00	7 00	18 00	11 00	17 00	61 00	7 00	17 00	16 50	-	293 75	201 50	131 50
Hingham,	29 00	63 00	52 00	27 50	38 00	-	45 00	76 00	60 00	72 00	16 70	29 96	791 50	509 16	509 16
Barnstable,	15 00	-	17 00	6 00	10 00	7 00	34 00	39 00	8 00	33 00	15 00	-	424 00	184 00	184 00
Nantucket,	22 00	75 75	-	-	20 00	-	4 00	64 00	28 00	12 00	15 00	-	420 75	240 75	240 75
Martha's Vineyard,	21 00	45 00	39 50	13 50	20 00	22 75	21 00	45 00	37 00	9 00	6 00	15 00	354 75	294 75	294 75
Totals,	$1,096 50	$1,515 75	$850 60	$410 75	$1,299 00	$744 75	$652 00	$9,260 60	$870 50	$910 00	$699 70	$932 96	$24,159 10	$19,319 11	$16,958 94

* Herds.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED—Continued.

FOR FARM PRODUCTS.

SOCIETIES.	Indian Corn.	Wheat.	Rye.	Barley.	Oats.	Beans.	Grass Crops.	Grass Seeds.	Potatoes.	Carrots.	Beets.	Parsnips.	English Turnips.	Ruta Bagas.	Onions.	Other Root Crops.
Massachusetts,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex,	-	-	-	-	-	$8 00	-	-	$13 00	$8 00	$8 00	-	-	$12 00	$8 00	$8 00*
Middlesex,	$8 00	$3 00	$2 00	-	$2 00	-	-	-	9 00	5 00	3 00	$3 00	$2 00	2 00	3 00	123 00*
Middlesex North,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Middlesex South,	17 00	-	-	-	-	5 00	-	-	-	5 00	-	-	-	-	-	42 00
Worcester,	-	3 00	1 00	-	2 00	-	-	-	8 00	2 00	4 00	2 00	4 00	2 00	2 00	9 50
Worcester West,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worcester North,	35 75	28 00	6 00	-	-	6 25	-	-	4 75	-	1 25	-	-	-	75	-
Worcester North-West,	1 00	-	-	-	-	1 00	-	$3 00	-	1 00	-	1 00	-	1 00	3 00	11 00
Worcester South,	-	5 00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worcester South-East,	3 00	-	-	$5 00	-	-	-	-	-	4 00	-	-	-	3 00	4 00	96 00
Hamps., Franklin & Hampden,	1 00	-	1 00	-	1 00	-	-	-	2 00	-	-	-	-	-	1 00	-
Hampshire,	2 00	3 00	3 00	-	1 00	-	-	1 00	1 00	1 00	1 00	-	1 00	1 00	1 00	1 00
Highland,	10 00	4 00	2 00	5 00	6 00	-	$5 00	-	9 75	5 00	2 00	-	-	5 00	50	-
Hampden,	50	-	-	-	-	-	-	5 50	-	-	50	1 00	-	50	50	-

Hampden East,	$2 25	$1 00	$1 25	-	$0 75	$1 50	-	-	$1 50	-	$0 75	$0 50	-	$2 00	$2 25	$25 00
Union,	-	-	-	-	-	-	-	†	-	-	-	-	-	-	-	-
Franklin,	2 00	15 00	-	-	-	4 00	-	-	3 00	-	5 00	-	-	-	-	12 85
Housatonic,	108 00	52 00	60 00	$21 00	52 00	-	‡41 00	$9 00	35 00	$14 00	8 00	‡21 00	-	10 00	2 50	31 50
Berkshire,	56 00	35 00	56 00	35 00	56 00	5 00	12 00	4 00	56 00	12 00	12 00	‡113 00	$12 00	12 00	-	-
Hoosac Valley,	21 00	15 00	14 00	15 00	15 00	3 00	9 00	‡53 00	21 00	-	5 00	-	6 00	-	3 00	-
Norfolk,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	79 00
Bristol,	30 00	-	5 00	-	-	-	-	-	-	-	-	-	5 00	-	-	-
Bristol Central,	47 00	1 00	2 00	1 00	6 00	1 00	-	-	18 00	6 00	1 00	-	-	-	18 00	20 00‡
Plymouth,	41 00	18 00	-	8 00	13 00	-	-	-	-	-	-	-	-	-	-	5 00
Marshfield,	6 25	-	6 00	-	-	1 75	-	-	10 00	5 00	-	-	8 00	-	3 00	1 00
Hingham,	12 00	-	-	‡10 00	-	-	-	-	-	-	-	-	-	-	-	28 00
Barnstable,	8 00	-	-	-	5 00	-	-	-	-	-	-	-	-	-	-	-
Nantucket,	6 00	-	-	-	10 00	-	-	-	-	5 00	4 00	-	5 00	-	-	-
Martha's Vineyard,	31 10	50	4 45	5 25	17 75	5 90	-	-	23 15	5 30	1 90	25	6 80	-	5 85	-
Totals,	$448 85	$183 50	$163 70	$105 25	$187 50	$42 40	$67 00	$75 50	$215 15	$78 30	$57 40	$141 75	$49 80	$50 50	$58 35	$492 35

* Vegetables. † No premiums awarded. ‡ Sundries.

Analysis of Premiums and Gratuities Awarded—Continued.

FARM PRODUCTS—Coucluded.

SOCIETIES.	Total amount offered for Grain and Root Crops.	Total am't awarded for Grain and Root Crops.	Total am't paid for Grain and Root Crops.	Am't awarded for Broomcorn Brush.	For Fruits.	For Flowers.	Any other cultivated Crops.	Milk.	Butter.	Cheese.	Honey.	Wheat Bread.	Rye and Indian Bread.	Corn Bread.	Total am't paid out under the head of Farm Products.
Massachusetts,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex,	$136 00	$65 00	$65 00	-	$117 50	$38 50	$60 00	-	$35 00	$13 00	$6 00	$13 50	-	-	$428 00
Middlesex,	167 00	165 00	165 00	-	227 50	39 25	24 00	-	15 00	-	3 00	20 00	$10 00	-	503 75
Middlesex North,	51 00	36 00	26 00	-	54 75	-	-	-	16 00	-	3 00	8 00	4 00	-	93 75
Middlesex South,	183 00	69 00	69 00	-	63 00	25 00	-	-	15 00	-	30 00*	12 00	6 00	-	210 00
Worcester,	45 00	41 50	41 50	-	64 00	9 00	-	-	23 00	56 00	-	6 00	5 00	$3 75	208 75
Worcester West,	52 00	-	-	-	61 00	17 75	13 50	-	10 00	54 00	-	6 00	5 00	-	147 75
Worcester North,	168 00	82 75	82 75	-	89 50	14 50	22 50	-	20 50	3 50	2 00	4 50	2 25*	-	223 00
Worcester North-West,	11 00	11 00	9 00	-	39 00	6 00	6 00	-	9 00	5 00	-	3 00	3 00	-	74 33
Worcester South,	-	-	-	-	29 25	5 00	29 25	-	9 00	18 00	-	12 00	6 00	-	-
Worcester South-East,	96 00	19 00	19 00	-	82 50	17 25	30 75	-	8 00	-	-	3 50	3 50	-	129 50
Hamps., Franklin & Hampden,	40 00	17 00	17 00	-	36 50	5 00	-	-	11 50	7 00	3 50	3 00	-	-	101 50
Hampshire,	35 00	28 00	28 00	-	43 50	27 00	-	-	14 00	10 00	4 00	5 00	13 00*	3 00	91 50
Highland,	94 00	54 25	54 25	-	12 75	3 00	12 25	$4 75*	6 50	6 00	1 00	75	75	75	102 75

Hampden,	$318 00	$8 50	$6 75	-	$16 50	-	-	-	$9 00	$3 00	-	$2 00	$3 00	-	$28 25
Hampden East,	156 00	38 75	-	-	29 25	$12 00	-	-	10 50	9 00	$2 00	3 00	5 00	-	109 50
Union,	48 00	-	-	-	9 25	1 50	$1 50	-	2 50	3 00	75	2 00	1 00	$0 75	15 25
Franklin,	138 50	41 85	37 50	$5 00	77 00	15 00	-	-	10 00	10 00	1 50	8 50	4 00	5 25	168 95
Housatonic,	454 00	465 00	465 00	-	121 00	35 00	-	$12 00	36 00	36 00	6 00	9 00	12 00	-	732 00
Berkshire,	497 00	493 00	493 00	-	104 00	20 00	-	-	41 00	50 00	9 00	20 00	10 00	10 00	757 00
Hoosac Valley,	225 00	157 00	157 00	-	67 00	15 00	15 00	-	15 00	35 00	21 00*	5 00	5 00	-	335 00
Norfolk,	123 00	79 00	55 50	-	129 00	22 00	-	-	21 00	-	-	14 00	4 00	-	261 00
Bristol,	203 00	40 00	40 00	-	-	-	-	-	-	-	-	-	-	-	-
Bristol Central,	201 00	121 00	121 00	-	65 00	6 50	7 00	-	34 00	23 00	24 00	3 00	75	-	163 25
Plymouth,	195 00	85 00	85 00	-	74 00	53 25	-	-	39 00	39 00	1 25	9 00	9 00	9 75*	319 25
Marshfield,	150 00	51 50	41 50	-	44 00	10 00	3 50	-	15 00	15 00	1 50	4 50	3 00	20 00*	132 85
Hingham,	139 00	50 00	50 00	-	76 75	27 45	34 10	-	14 50	5 00	9 00	5 50	3 00	-	224 94
Barnstable,	95 00	13 00	13 00	-	36 00	13 50	-	-	6 00	5 00	-	6 00	6 00	-	111 50
Nantucket,	165 00	63 00	63 00	-	31 50	16 50	-	-	12 00	2 00	-	4 00	-	-	128 00
Martha's Vineyard,	166 00	108 20	108 20	-	43 40	6 00	-	-	11 00	5 50	2 50	5 75	4 75	2 50	188 70
Totals,	$4,371 50	$2,379 30	$2,313 45	$5 00	$213 30	$460 95	$259 35	$16 75	$469 00	$413 00	$131 00	$199 50	$129 00	$55 75	$5,989 02

* Sundries.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED—Concluded.

MISCELLANEOUS.

SOCIETIES.	For Agricultural Implements.	Offered for raising forest trees.	Awarded for the same.	For experiments on manures.	Amount awarded for objects strictly agricultural, not specified before.	For objects not strictly agricultural; domestic manufactures, &c.	No. of persons who received premiums and gratuities.
Massachusetts,	-	$1,000 00	-	-	-	-	3
Essex,	$50 00	30 00	-	$25 00	-	$148 00	-
Middlesex,	45 00	-	-	-	-	152 25	260
Middlesex North,	-	-	-	-	-	-	110
Middlesex South,	46 00	60 00	-	15 00	-	73 00	175
Worcester,	-	22 00	-	-	-	43 00	-
Worcester West,	11 50	30 00	-	10 00	-	89 00	190
Worcester North,	43 00	50 00	-	-	-	173 50	179
Worcester North-West,	-	-	-	-	-	82 25	98
Worcester South,	2 00	35 00	-	-	-	61 27	161
Worcester South-East,	1 00	30 00	-	-	-	129 62	158
Hampshire, Franklin and Hampden,	25 00	20 00	-	-	$6 00	71 25	188
Hampshire,	21 00	12 00	-	40 00	-	53 72	300
Highland,	5 25	-	-	-	-	86 75	169
Hampden,	17 00	15 00	-	-	-	10 50	29
Hampden East,	7 00	25 00	-	26 00	-	75 25	83
Union,	13 00	-	-	-	2 50	50 15	98
Franklin,	15 00	10 00	-	9 00	92 38*	95 00	238
Housatonic,	33 00	-	-	-	-	337 00	369
Berkshire,	84 00	-	-	-	102 00	314 50	397
Hoosac Valley,	-	-	-	-	-	200 00	328
Norfolk,	27 50	25 00	-	-	-	37 75	144
Bristol,	-	30 00	-	60 00	-	-	-
Bristol Central,	-	-	-	-	-	388 50	260
Plymouth,	15 00	60 00	-	-	68 25	233 25	395
Marshfield,	7 50	50 00	-	-	-	155 00	286
Hingham,	-	50 00	-	-	-	292 48	500
Barnstable,	-	7 50	-	12 00	27 00	80 00	200
Nantucket,	-	13 00	-	16 00	-	75 00	154
Martha's Vineyard,	-	25 00	-	16 00	26 50	90 15	194
Totals,	$468 75	$1,599 50	-	$229 00	$324 63	$3,598 14	5,666

* Miscellaneous.

NAMES of Cities and Towns to which the Premiums and Gratuities were disbursed, and the amount to each.

MASSACHUSETTS.

Canton,	$150 00	Worcester,	$100 00
Tyngsborough,	200 00	Total,	$450 00

ESSEX.

Amesbury,	$29 00	Marblehead,	$34 00
Andover,	8 00	Methuen,	11 00
Boston,	26 00	Newbury,	199 00
Boxford,	9 00	Newburyport,	450 00
Bradford,	18 00	North Andover,	75 00
Danvers,	45 00	Peabody,	13 00
Essex,	5 00	Rowley,	16 00
Groveland,	5 50	Salem,	12 00
Hamilton,	35 00	Salisbury,	1 50
Haverhill,	30 00	Wenham,	13 00
Ipswich,	36 00	West Newbury,	104 00
Lawrence,	8 00	Total,	$1,183 00

MIDDLESEX.

Acton,	$103 00	Framingham,	$19 50
Arlington,	59 00	Groton,	5 00
Bedford,	23 00	Harvard,	5 00
Belmont,	138 50	Holliston,	5 00
Billerica,	4 00	Hudson,	21 00
Boston,	11 00	Lexington,	197 00
Burlington,	18 00	Lincoln,	133 00
Boxborough,	7 00	Littleton,	31 50
Cambridge,	92 00	Malden,	3 00
Carlisle,	16 00	Marlborough,	5 00
Chelmsford,	50	Medford,	8 00
Concord,	227 25	Natick,	8 00
Fitchburg,	13 00	Pepperell,	8 00

MIDDLESEX — Concluded.

Providence,	$10 00	Watertown,	$11 00
Reading,	12 50	Wayland,	34 00
Somervillle,	4 00	Washington,	2 00
Stoneham,	10 00	Westford,	2 00
Stow,	5 00	Weston,	38 50
Sudbury,	37 50	Winchester,	14 00
Townsend,	1 50	Woburn,	18 00
Wakefield,	8 00		
Waltham,	46 75	Total,	$1,416 30

MIDDLESEX NORTH.

Acton,	$14 25	Reading,	$4 00
Billerica,	6 00	Tyngsborough,	3 50
Chelmsford,	67 50	Tewksbury,	54 00
Dracut,	25 75	Wakefield,	3 00
Dunstable,	44 00	Winchester,	4 50
Lowell,	100 75	Total,	$327 25

MIDDLESEX SOUTH.

Ashland,	$8 50	Sherborn,	$7 75
Framingham,	671 25	Southborough,	88 00
Holliston,	8 00	Sudbury,	7 75
Hopkinton,	23 75	Sundries out of district,	494 00
Marlborough,	22 50	Wayland,	72 00
Natick,	84 50	Total,	$1,488 00

WORCESTER.

Auburn,	$2 50	Fitchburg,	$52 00
Barre,	117 00	Grafton,	9 50
Bolton,	10 00	Holden,	18 00
Boylston,	8 00	Millbury,	135 00
Brookfield,	120 00	New Braintree,	42 00
Charlton,	9 00	Princeton,	162 00
Dudley,	6 00	Rutland,	10 00

WORCESTER—CONCLUDED.

Shrewsbury,	$37 00	West Boylston,	$51 00
Southbridge,	25 00	Webster,	43 00
Spencer,	6 00	Westborough,	50 00
Sturbridge,	46 00	Worcester,	50 00
Sutton,	165 00	Total,	$1,174 00

WORCESTER WEST.

Barre,	$379 00	Princeton,	$58 00
Charlton,	43 00	Royalston,	13 00
Framingham,	30 00	Spencer,	3 00
Hardwick,	58 00	Springfield,	25 00
Hubbardston,	5 00	Sturbridge,	17 00
New Braintree,	54 50	Sutton,	31 00
North Brookfield,	23 00	Warren,	5 00
Oakham,	28 00	West Brookfield,	9 00
Palmer,	125 00	Worcester,	230 00
Petersham,	13 00		
Phillipston,	9 00	Total,	$1,158 50

WORCESTER NORTH.

Ashburnham,	$9 00	Oakdale,	$1 25
Ashland,	1 00	Princeton,	257 25
Barre,	120 00	Shirley,	65 00
Boston,	175 00	Sterling,	27 00
Fitchburg,	534 00	West Boylston,	11 00
Lancaster,	50	Westminster,	61 00
Leominster,	115 25	Winchendon,	1 50
Lunenburg,	73 50	Wilton,	10 00
Littleton,	63 00	Worcester,	2 00
New Ipswich,	23 00	Total,	$1,563 25

WORCESTER NORTH-WEST.

Athol,	$294 55	Erving,	$0 50
Barre,	122 66	Montague,	23 67

WORCESTER NORTH-WEST—CONCLUDED.

New Salem,	$3 00	State of Michigan,	$0 67
Orange,	4 33	Templeton,	18 33
Phillipston,	123 02	Winchendon,	50 00
Petersham,	13 00	Worcester,	8 00
Royalston,	9 67	Total,	$671 40

WORCESTER SOUTH.

Brimfield,	$48 75	Spencer,	$0 50
Brookfield,	47 00	Sturbridge,	196 77
Charlton,	166 10	Sutton,	31 00
Dudley,	51 50	Warren,	30 25
Holland,	8 00	Webster,	35 50
Melrose,	2 00	Worcester,	21 00
Oxford,	5 00		
Southbridge,	112 15	Total,	$756 52

WORCESTER SOUTH-EAST.

Bellingham,	$9 75	Southborough,	$6 00
Blackstone,	6 00	Sutton,	37 00
E. Brimfield,	3 00	Upton,	26 50
Framingham,	10 00	Uxbridge,	30 00
Holliston,	23 75	Westborough,	39 75
Hopkinton,	32 25	Worcester,	13 00
Mendon,	183 00	Wrentham,	2 00
Medway,	50		
Milford,	280 00	Total,	$702 50

HAMPSHIRE, FRANKLIN AND HAMPDEN.

Amherst,	$16 00	Gill,	$35 00
Chesterfield,	1 00	Goshen,	3 00
Conway,	42 00	Hatfield,	83 25
Cummington,	14 40	Hadley,	35 25
Deerfield,	109 00	Huntington,	8 00
Easthampton,	44 00	Leverett,	8 00

HAMPSHIRE, FRANKLIN AND HAMPDEN—Concluded.

Northampton,	$211 00	Westhampton,	$9 75
Prescott,	21 00	Whately,	13 20
Southampton,	37 00	Williamsburg,	19 50
Shelburne,	137 00		
Sunderland,	21 59	Total,	$864 44
South Hadley,	5 50		

HAMPSHIRE.

Amherst,	$174 00	Leverett,	$32 12
Belchertown,	55 00	Montague,	20 00
Dana,	150 00	Pelham,	28 00
Enfield,	15 00	Prescott,	9 00
Granby,	37 00	South Hadley Falls,	7 00
Hatfield,	4 00	Sunderland,	73 00
Hartford, (Ct.,)	3 00	Williamsburg,	14 00
Hadley,	129 50		
Ludlow,	2 00	Total,	$604 12

HIGHLAND.

Becket,	$51 25	Meriden,	$4 00
Blandford,	7 00	Middlefield,	230 50
Chester,	65 50	Peru,	6 00
Chesterfield,	2 00	Palmer,	15 00
Cummington,	5 00	Russell,	3 25
Dalton,	11 00	Springfield,	1 25
Easthampton,	1 75	Washington,	13 00
Hinsdale,	107 25	Westfield,	10 00
Holyoke,	6 00	Windsor,	1 00
Huntington,	7 50	Worthington,	16 25
Lanesborough,	18 50		
Lee,	10 00	Total,	$647 00

HAMPDEN.

Chicopee,	$3 25	West Springfield,	$33 00
Longmeadow,	72 25	Wilbraham,	1 00
Springfield,	80 00		
Westfield,	4 00	Total,	$193 50

HAMPDEN EAST.

Belchertown,	$53 25	Shrewsbury,	$4 00
Brimfield,	25 50	Springfield,	4 50
Chicopee,	3 00	Warren,	9 00
Ludlow,	8 00	Wilbraham,	3 00
Monson,	268 50		
Palmer,	148 75	Total,	$527 50

UNION.

Blandford,	$138 50	Otis,	$7 00
Chester,	6 00	Russell,	6 50
Granville,	15 50	Westfield,	19 50
Huntington,	50		
Miscellaneous,	3 25	Total,	$196 75

FRANKLIN.

Bernardston,	$30 25	Heath,	$5 00
Buckland,	9 75	Leverett,	19 25
Coleraine,	28 25	Montague,	29 25
Conway,	36 25	Northfield,	31 75
Deerfield,	108 15	Rowe,	1 50
Erving,	9 25	Shelburne,	327 50
Gill,	46 65	Sunderland,	34 00
Greenfield,	157 03	Total,	$873 83

HOUSATONIC.

Adams,	$4 00	Mount Washington,	$12 00
Alford,	71 50	New Marlborough,	51 00
Becket,	18 00	Pittsfield,	8 00
Egremont,	201 50	Richmond,	2 00
Great Barrington,	591 00	Sheffield,	427 00
Lanesborough,	3 00	Stockbridge,	186 00
Lee,	129 00	West Stockbridge,	65 00
Lenox,	120 00		
Monterey,	42 00	Total,	$1,931 00

BERKSHIRE.

Alford,	$5 00	North Adams,	$9 00
Becket,	1 00	Peru,	8 00
Cheshire,	112 00	Pittsfield,	852 00
Dalton,	107 00	Richmond,	87 00
Egremont,	8 00	Sheffield,	78 00
Great Barrington,	38 00	South Adams,	73 00
Hancock,	3 00	South Williamstown,	14 00
Hinsdale,	38 00	Stockbridge,	149 00
Lanesborough,	259 50	Washington,	4 00
Lee,	123 00	West Stockbridge,	12 00
Lenox,	354 50	Williamstown,	37 00
Monterey,	2 00	Windsor,	14 00
New Ashford,	11 00		
New Marlborough,	50	Total,	$2,399 50

HOOSAC VALLEY.

Cheshire,	$77 50	Pittsfield,	$7 50
Clarksburg,	29 00	Pownal,	44 50
Dalton,	8 00	Savoy,	1 00
Florida,	17 50	South Adams,	92 50
Greenfield,	1 00	Stamford,	16 00
Lanesborough,	13 50	Williamstown,	290 00
Lenox,	15 00		
North Adams,	344 00	Total,	$957 00

NORFOLK.

Brookline,	$12 00	Needham,	$98 00
Canton,	39 00	Randolph,	4 00
Dedham,	99 00	Roxbury,	131 00
Dorchester,	100 00	Sharon,	275 00
Dover,	13 50	Stoughton,	33 00
Franklin,	10 00	Walpole,	12 50
Hyde Park,	16 00	Weymouth,	270 00
Medfield,	14 00	West Roxbury,	81 25
Milton,	134 00		
Out of the County,	364 25	Total,	$1,461 25

BRISTOL CENTRAL.

Acushnet,	$75 50	New Bedford,	$356 05
Berkley,	67 50	Norton,	26 00
Bridgewater,	163 00	Raynham,	77 50
Dartmouth,	101 50	Rochester,	24 00
Fall River,	544 50	Somerset,	167 00
Fairhaven,	48 00	Swansea,	188 00
Freetown,	99 50	Taunton,	406 10
Lakeville,	130 20	Westport,	51 00
Myrickville,	34 50	Total,	$2,559 85

PLYMOUTH.

Abington,	$53 00	Middleborough,	$108 25
Braintree,	45 00	Mattapoisett,	34 00
Bridgewater,	686 75	North Bridgewater,	353 00
East Bridgewater,	134 00	Plymouth,	38 00
Foxborough,	2 00	Plympton,	47 25
Halifax,	68 00	Rochester,	19 00
Hanover,	2 00	Stoughton,	50
Hingham,	4 50	Taunton,	45 00
Kingston,	10 00	Wareham,	75
Lakeville,	53 35	West Bridgewater,	141 50
Marion,	1 00	Weymouth,	4 50
Mansfield,	5 00		
Marshfield,	6 00	Total,	$1,862 35

MARSHFIELD.

Abington,	$1 75	Marshfield,	$272 05
Boston,	29 50	Medford,	75
Duxbury,	108 62	Pembroke,	19 25
Easton,	3 75	Plymouth,	21 50
Halifax,	50	Plympton,	50
Hanson,	50	Scituate,	25 00
Hanover,	3 50	Weymouth,	5 75
Kingston,	12 25	Total,	$505 17

HINGHAM.

Abington, ...	$10 25	Quincy, ...	$13 40
Cohasset, ...	25 00	South Scituate, . . .	50 00
Hanover, ...	15 00	Weymouth, ...	38 00
Hingham, ...	820 39		
Hull, ...	23 00	Total, ...	$995 04

BARNSTABLE.

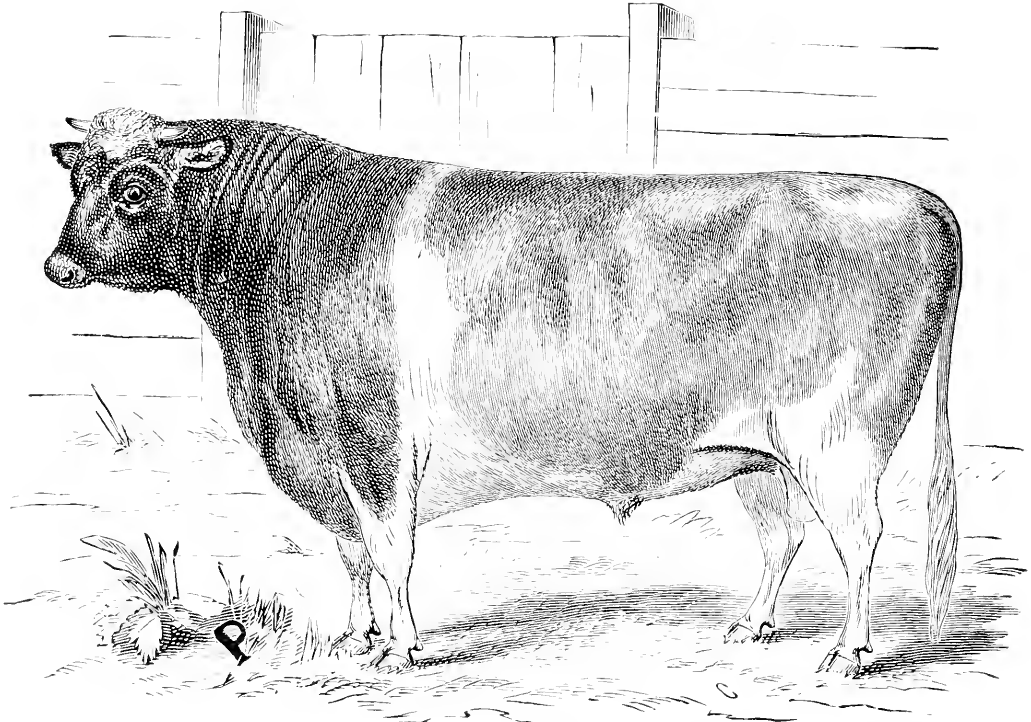
Barnstable, ...	$336 00	Sandwich, ...	$35 00
Brewster, ...	3 00	Yarmouth, ...	17 00
Chatham, ...	5 00	Unknown, ...	20 00
Dennis, ...	34 00		
Harwich, ...	4 00	Total, ...	$454 00

NANTUCKET.

Nantucket, ...	$559 00

MARTHA'S VINEYARD.

Chilmark, ...	$220 15	Tisbury, ...	$320 70
Edgartown, ...	69 05	Total, ...	$609 90



"IVANHOE" JERSEY.—OWNED BY J C. CONVERSE, SOUTHBOROUGH.

See Preface to 2d Part.

ABSTRACT OF RETURNS

OF THE

AGRICULTURAL SOCIETIES

OF

MASSACHUSETTS,

1869.

EDITED BY

CHARLES L. FLINT,

SECRETARY OF THE STATE BOARD OF AGRICULTURE.

BOSTON:

WRIGHT & POTTER, STATE PRINTERS,

79 MILK STREET, (CORNER OF FEDERAL.)

1870.

PREFACE.

I am indebted to the owners of the animals illustrated in this volume for the use of the engravings which they have so kindly furnished.

The beautiful Shorthorn heifer "Lucy," received the first prize of the Middlesex Agricultural Society as the best under three years old. She is roan, bred by and the property of Jos. A. Harwood, Littleton, Mass.; calved May 10th, 1868; got by "Roan Prince," 6,370, out of "Flirt," by "Marmion," 1843,—"Lady Sale Ninth," by "Comet," 3,772,—"Lady Sale Sixth," by "Red Knight," 890,—"Lady Sale Third," by imported "Duke of Cambridge," 1,034 (5,941),—"Lady Sale Second," by "Earl of Chatham," (10,176),—"Lady Sale," by "General Sale," (8,099),—"Clara," by "Napier," (1,238),—"Maid of Orleans," by "Mameluke," (2,258),—"Helena," by "Waterloo," (2,816),—"Moss Rose," by "Baron," (58),—"Angelina," by "Phenomenon," (491),—"Anne Boleyn," by "Favorite," (252),—"Princess," by "Favorite," (252),—"Brighteyes," by "Favorite," (252),—"Beauty," by "Masterman's," (273),—"Tripes," by the Studly bull, (621).

The little Brittany beauty, the "Empress," owned by William Knowlton, Esq., of Upton, was imported by me from France in the month of June, 1868 then coming two years old and with calf. She dropped a beautiful heifer calf two days after reaching the end of her long journey. She is a perfect dairy cow in miniature, of wonderful delicacy and fineness of limb and skin, neck and head. Her weight at the present time, being in high condition and with calf, is about 400 lbs., color, black and white. In disposition she is gentle as a kitten, and a good-natured, frolicsome pet. She gives from seven to eight quarts of a milk that is remarkable for making the finest flavored butter in the world, the Bretons being adapted especially to the butter dairy in regions of short pasturage and limited fertility. The consumption per day in food is about ten to twelve pounds of hay, or its equivalent. The height of the Brittanies varies from thirty-two to forty inches. The bull imported at the same time

with the "Empress," was just thirty-two inches high, measured over the fore-shoulder, when he arrived, being then one year old.

"Napoleon," imported in his dam, was calved soon after she reached her destination. He has grown finely and is already or is soon to be the father of a somewhat numerous progeny. The size and height can be inferred by the figure of the herdsman standing by his side.

"Ivanhoe," the Jersey bull owned by JAMES C. CONVERSE, Esq., and kept at his farm in Southborough, is remarkable for his form and beauty. In striking points of excellence he is rarely excelled by any bull of his age and breed in the country.

He was sired by "Excelsior," he by imported "Ned" out of J. P. Cushing's "No. 3," bred from stock of his own importation. Dam, "Delpha," by imported "Santa Anna," out of imported "Dolly." "Delpha" was awarded the first premium at the exhibition of the "Newton Jersey Club" in 1868, the committee consisting of Thomas Motley, (Chairman,) Dr. Joseph Burnett and Leverett Saltonstall. She was also one of the three cows, ("Lady Milton" and "Creampot" being the others,) forming part of the Jersey herd which drew the *herd prize* at the *New England Fair*, at New Haven, in 1868.

The drawing of these animals was done by JOHN R. PAGE, Esq., and the engraving by R. H. CARSON, Esq., of New York.

I must again call the attention of the officers of societies, as I have so often done before, to the fact that, in many cases, their "Transactions" are meagre and unworthy of them. This gross neglect of a most obvious and important duty, and disregard of the obligations to the State, is discreditable in the highest degree.

The officers of societies should remember that the fair or exhibition is only one of the methods of doing good, and a subordinate and ephemeral one at the best; that the great and primary duty is to gain and diffuse information through its record; that the printed page, full of instruction, life and interest, goes forth to awaken a degree of inspiration in the community which no exhibition, however complete, can do so well; that it is the permanent record that is to spread and perpetuate its influence for good and that the State has a right to expect that every society will do its duty in this respect.

CHARLES L. FLINT.

BOSTON, Jan. 26, 1870.

OFFICERS OF THE AGRICULTURAL SOCIETIES.
1870.

MASSACHUSETTS.

President—GEORGE W. LYMAN, of Boston.
Secretary—PETER C. BROOKS, Jr., of Boston.

ESSEX.

President—WILLIAM SUTTON, of Peabody.
Secretary—CHARLES P. PRESTON, of Danvers.

MIDDLESEX.

President—JOHN CUMMINGS, Jr., of Woburn.
Secretary—JOHN B. MOORE, of Concord.

MIDDLESEX NORTH.

President—JONATHAN LADD, of Lowell.
Secretary—E. T. ROWELL, of Lowell.

MIDDLESEX SOUTH.

President—GEORGE B. BROWN, of Framingham.
Secretary—JAMES W. BROWN, of Framingham.

WORCESTER.

President—SOLOMON H. HOWE, of Bolton.
Secretary—WINSLOW S. LINCOLN, of Worcester.

WORCESTER WEST.

President—JAMES W. JENKINS, of Barre.
Secretary—CHARLES BRIMBLECOM, of Barre.

WORCESTER NORTH.

President—WM. WOODBURY, of Fitchburg.
Secretary—WALTER A. EAMES, of Fitchburg.

WORCESTER NORTH-WEST.

President—FARWELL W. FAY, of Athol.
Secretary—E. T. LEWIS, of Athol.

WORCESTER SOUTH.

President—SYLVESTER DRESSER, of Southbridge.
Secretary—HENRY HAYNES, of Sturbridge.

WORCESTER SOUTH-EAST.

President—WILLIAM KNOWLTON, of Upton.
Secretary—J. ALLEN FAY, of Milford.

HAMPSHIRE, FRANKLIN AND HAMPDEN.

President—ELNATHAN GRAVES, of Williamsburg.
Secretary—A. PERRY PECK, of Northampton.

HAMPSHIRE.

President—LEVI P. WARNER, of Sunderland.
Secretary—R. W. STRATTON, of Amherst.

HIGHLAND.

President—METCALF J. SMITH, of Middlefield.
Secretary—JONATHAN McELWAIN, of Middlefield.

HAMPDEN.

President—GEORGE DWIGHT, of Springfield.
Secretary—J. N. BAGG, of West Springfield.

HAMPDEN EAST.

President—WM. HOLBROOK, of Palmer.
Secretary—O. P. ALLEN, of Palmer.

UNION.

President—WILLIAM M. LEWIS, of Blandford.
Secretary—H. P. ROBINSON, of Blandford.

FRANKLIN.

President—HENRY WELLS, of Shelburne.
Secretary—SAMUEL J. LYONS, of Greenfield.

BERKSHIRE.

President—JOHN E. MERRILL, of Pittsfield.
Secretary—WM. H. MURRAY, of Pittsfield.

HOUSATONIC.

President—PARLEY A. RUSSELL, of Great Barrington
Secretary—HENRY T. ROBBINS, of Great Barrington.

HOOSAC VALLEY.

President—JOHN M. COLE, of Williamstown.
Secretary—H. CLAY BLISS, of North Adams.

NORFOLK.

President—JOHN S. ELDRIDGE, of Canton.
Secretary—HENRY O. HILDRETH, of Dedham.

MARSHFIELD.

President—GEORGE M. BAKER, of Marshfield.
Secretary—WARREN W. BARKER, of Marshfield.

BRISTOL.

President—WILLIAM MASON, of Taunton.
Secretary—EZRA DAVOL, of Taunton.

BRISTOL CENTRAL.

President—NATHAN DURFEE, of Fall River.
Secretary—ROBERT ADAMS, of Fall River.

PLYMOUTH.

President—CHARLES G. DAVIS, of Plymouth.
Secretary—LAFAYETTE KEITH, of Bridgewater.

HINGHAM.

President—ALBERT FEARING, of Hingham.
Secretary—FEARING BURR, of Hingham.

BARNSTABLE.

President—CHARLES C. BEARSE, of Barnstable.
Secretary—CHARLES F. SWIFT, of Yarmouth Port.

NANTUCKET.

President—JAMES THOMPSON, of Nantucket.
Secretary—ALEX. MACY, Jr., of Nantucket.

MARTHA'S VINEYARD.

President—BENJAMIN DAVIS, of Edgartown.
Secretary—DAVID MAYHEW, of Tisbury.

AGRICULTURAL EXHIBITIONS.

1870.

ESSEX, at *Ipswich*, ...	. September 27 and 28.
MIDDLESEX, at *Concord*, . . .	. October 4 and 5.
MIDDLESEX NORTH, at *Lowell*, . .	. September 28 and 29.
MIDDLESEX SOUTH, at *Framingham*,	. September 20 and 21.
WORCESTER, at *Worcester*, . . .	. September 22 and 23.
WORCESTER WEST, at *Barre*, . .	. September 29 and 30.
WORCESTER NORTH, at *Fitchburg*, .	. September 27 and 28.
WORCESTER NORTH-WEST, at *Athol*, .	. October 5 and 6.
WORCESTER SOUTH, at *Sturbridge*, .	. September 8 and 9.
WORCESTER SOUTH-EAST, at *Milford*,	. September 27 and 28.
HAMPSHIRE, FRANKLIN AND HAMPDEN, at *Northampton*, ...	. October 6 and 7.
HAMPSHIRE, at *Amherst*, ...	. September 27 and 28.
HIGHLAND, at *Middlefield*, ...	. September 15 and 16.
HAMPDEN, at *Springfield*, ...	. October 4 and 5.
HAMPDEN EAST, at *Palmer*, . . .	. October 11 and 12.
UNION, at *Blandford*, ...	. September 27 and 28.
FRANKLIN, at *Greenfield*, ...	. September 29 and 30.
BERKSHIRE, at *Pittsfield*, ...	. October 4, 5 and 6.
HOUSATONIC, at *Great Barrington*, .	. September 28, 29 and 30.
HOOSAC VALLEY, at *North Adams*, .	. September 20, 21 and 22.
NORFOLK, at *Readville*, ...	. September 22 and 23.
MARSHFIELD, at *Marshfield*, . . .	. October 6 and 7.
BRISTOL, at *Taunton*, ...	. October 4, 5 and 6.
BRISTOL CENTRAL, at *Myrick's*, . .	. September 21, 22 and 23.
PLYMOUTH, at *Bridgewater*, . . .	. September 29, 30, and October 1.
HINGHAM, at *Hingham*, ...	. September 27 and 28.
BARNSTABLE, at *Barnstable*, . . .	. October 4 and 5.
NANTUCKET, at *Nantucket*, ...	. September 28 and 29.
MARTHA'S VINEYARD, at *West Tisbury*,	. October 18 and 19.

AGRICULTURE OF MASSACHUSETTS.

EXPERIENCE OF A PRACTICAL FARMER.

From an Address before the Essex Agricultural Society.

BY BENJAMIN P. WARE.

Within my remembrance, it was a laborious task for a man to conduct the business of the farm successfully. He was expected to turn the double swath in the mowing-field, to lead the hired men as they were desired to follow, to pitch on the hay, to hoe the hardest row; in short, to bear the brunt of the work. Great physical strength and endurance, as well as good judgment, were indispensable. But now what a change! To lead the labor of the farm does not require great strength and power of muscle, but brains are called into requisition, and skill in the management of machinery.

The farmer, while riding around his field on the mowing-machine, hay-tedder or horse-rake, may overlook and direct those less skilled than himself, and at the same time accomplish the labor of ten men, with no more exertion than is pleasant for exercise. With Raymond's hay-elevator he may stow away his hay in his barn with comparatively little labor and a great saving of time; but the farmer impatiently awaits the time when he may for his money obtain an improved hay-loading machine, so vainly sought by many of us.

The potato crop can now be grown entirely without hand labor. True's potato-planter cuts the potato, drops, furrows and covers, at one operation. With Holbrook & Chandler's horse-hoes, the labor of hoeing is wholly performed by horse-power.

By the use of the side-hill plough, the harrow and the drag, that any farmer can make in two hours, costing not more than two dollars for materials,—than which no greater labor-saving implement has yet been invented for the farm,—and with Willis' seed-sower, the Danvers truckle-hoe, all of the root-crops can be grown with about one-half the labor formerly required.

The changing of an inferior variety of apples or pears for a superior one, is now so simplified and made easy, by the use of a liquid grafting-wax, applied with a brush, that no one need be without the choicest kind of such fruit who has healthy, vigorous trees, of whatever size they may be. Nor has improvement stopped here. We need not leave Essex County to find that within a few years there have been introduced, by skill and careful cultivation, the Hubbard squash, the stone mason and Marblehead mammoth cabbages, Emery's early cabbage, a superior early tomato and lettuce, the Danvers onion, all better, in some respects, than before existed; and to the list of fruits have been added Allen's two hybrid grapes, and those of Mr. Rogers, possessing qualities superior to those of any others, while other parts of the State have added Dana's Hovey and Clapp's Favorite pears, the Concord grape and the President Wilder strawberry.

Other fruits and vegetables might well be mentioned. The neighboring State of Vermont has made such vast strides in the improvement of the potato as to cause those who have lived through the *morus multicaulus*, Rohan potato and hen-fevers to stand aghast, waiting for the excitement to abate, to see if Bresee's No. 4 is really two hours earlier than the Early Rose. But all may be assured that great improvement has really been made in the potato. And yet there are persons among that numerous class, who, because they lived upon a farm until seventeen years of age, and so, forsooth, "know all about farming," are asking what improvement has been made in agriculture.

Who ever heard, until within a few years, of seventy-four tons of mangel-wurzel being grown upon one acre of land? of thirty-six tons of carrots or nine hundred bushels of onions per acre? Such crops as these are facts that can be proved. Such crops have been grown and can be grown again.

Several French and German chemists have estimated the value of English hay in comparison with other kinds of food for

milch cows, and they make two hundred and fifty pounds of beet-roots equal to one hundred pounds of hay. According to this estimate, the above crop of mangolds would equal in value nearly thirty tons of hay; or supposing the chemists' estimate to be only half right, the root-crop would then equal fifteen tons of hay per acre. It has been ascertained, by actual experiment that breeding-swine can be kept upon raw mangolds alone from October to May in good thrifty condition. Can any one doubt, with such facts, the great advantage of growing this and other root-crops?

Various breeds of foreign cattle have also been thoroughly tested; and in my opinion the Ayrshire stock has proved the best adapted to our pastures, and, for milking qualities, heads the list. Doubtless there are some specimens among our native stock as good as the best of any foreign breed for milk, but the native breed cannot be so generally relied upon; therefore the thanks of the farmers of Essex are due to the Massachusetts Society for the Promotion of Agriculture, and to some private individuals, for the introduction of that superior breed of cattle.

I think any close observer of the cattle-pens at our exhibitions for the last twenty years will have noticed this fact: that any breed, of whatever size, will, within two or three generations, become adapted in size and form to the locality and pastures in which it is placed, although retaining more or less of its own peculiar marks and qualities. Hence the economy of introducing such breeds as correspond pretty nearly in size with our native cattle.

Although two years in succession of severe drought, which occurred four or five years ago, so weakened the fruit-buds of the apple-trees as nearly to destroy the crop of fruit, and the canker-worm, with other insects, has since committed such ravages upon our orchards as to make the cultivation of the apple rather discouraging, yet let us take heart. By the use of printer's ink and tarred paper from November 1 to April 1, at a cost of from five to eight cents per tree, our orchards can be perfectly protected from the canker-worm; and by securing the small birds from the depredation of their natural enemies, idle boys, cats and crows, and with good cultivation, I feel sure that we may again be blessed with abundant crops of that beautiful, delicious and health-giving fruit. Thus we shall be enabled to

return the compliment of presenting to our modern Eve the no longer forbidden fruit, and under such circumstances and conditions, that we may realize that the Paradise once lost is regained.

Who that has planted an apple-tree, grafted, trained and cultivated it, protected and cared for it from its nursery growth to its orchard maturity, does not love it with a paternal love? With what pleasurable emotions he recognizes the friendly greeting of its gentle nod on a Whitsunday morning, as he beholds it, one mass of rose and lily blossoms, filling the sunny air with fragrance, and listens to the soft murmur of delight issuing from its branches. As he stands thus, what man can avoid thanking his God for being allowed to aid in such a creation? And again, in October, with what satisfaction he approaches his tree, with basket and barrels, to harvest those glorious pippins that hang so temptingly within his reach, affording ample means of profit, health and luxury. Who that owns an acre of land can afford to dispense with so much happiness as may be derived from an apple-tree? Certainly no Essex County farmer. My own experience is, that no part of my farm yields greater income for the labor expended than the orchard. If the crop is small, the price is usually large. Let us then continue to cultivate the apple as a source of profit, of health to our families, and of growth to our social natures.

Besides protecting our native songsters, that do so much to aid the orchardist, I most earnestly recommend the importation of English sparrows, whose principal occupation is to feed their numerous progeny with insects. The experiment was tried in New York three years ago, and proving very successful, led to the introduction of these birds, last spring, into Philadelphia. I know of no way by which a portion of the income of this society can be so profitably expended as by the importation of several thousands of these birds, to be distributed in different parts of the county.

It may be worth the notice of the curious observer, that of the several varieties of apple and pear-trees, each grows with form and feature peculiar to itself, and varies as much as do the different kinds of fruit. No one familiar with them can mistake, for example, the Pickman Pippin, Ribstone Pippin or Killhamhill, among apple-trees, or the Winter Nelis, Louise Bonne

de Jersey or Rostiezer, among pear-trees. So marked are their peculiarities, however different the stocks these varieties are grafted into, that the quality of the fruit (other things being equal,) remains the same. It is also a well-established fact that in nursery rows of seedling apple-trees, budded at one year old, and taken up at four years of age, each row being budded with a different kind of fruit, the roots of the several varieties will be found to have taken different habits of growth—one variety will have numerous small, fibrous roots, growing compactly, while another row, of a different variety, will have a few large and long roots, with few fibres, the varieties of fruit giving distinct habits of root, although the stocks may all differ from each other. This proves conclusively that the stock exerts no influence upon the variety of fruit engrafted into it, but that the graft does have an influence in forming the habit of the roots of the stock. The same observer may with propriety ask, how is it that when two scions are engrafted into a limb of an apple-tree, one will produce fruit, ripe in August, of yellow color and sweet flavor, while the other will produce fruit, ripe in January, of red color and acid flavor, both kinds nourished by the same sap, supplied from the same roots? Whence the difference?

I think this question can be answered, by saying that the material of the fruit is supplied principally from the soil through the roots, while the quality of it is derived from the atmosphere through the leaves. Hence the idea of improving the quality of fruit by double working must be a fallacy.

Let me say a word of the tendency of the sons of farmers to leave the calling of their fathers. I knew a farmer who took his son, a lad of fourteen, into the field to assist him in setting out a young apple orchard. That boy obeyed his father's directions to the letter. If he told him to move a tree to the right or left, to set it deeper or not so deep, he obeyed; no more, no less; but his heart was not in his work. That father saw and keenly felt his son's apathy. He said: "My son, I will listen to any suggestions you may offer with regard to the setting of these trees." From that moment the boy was changed. What! thought he, does my father wish for suggestions from me? And if so, should they not be made after careful thought and consideration, that they may be worthy of his attention? Thus he

argued with himself; thus his mind was turned to the business of the farm; thus he learned to love it; and one boy was saved to the farm, whose mind was already wandering off in search of some other business or profession.

Thirty years have since been added to that boy's life, passed in the various labors and experiences of the farm, and here, to-day, he rejoices in his early choice, and is proud of his vocation.

Fellow farmer, have not you a son that you wish should become a farmer? Encourage him to bestow thought upon the business; listen to his suggestions; if good, show him that you appreciate them; if not practicable, convince him of it. Put him in responsible positions according to his ability; teach him to manage farm machinery; to observe the growth of plants; give him an interest in the poultry, in a vegetable garden or in the cultivation of small fruits; a calf or a colt, to raise on his own account; and, above all, see to it that you teach him all that you know yourself about farming, that he may begin where you leave off. In this way, though he may have no greater capacity than you, much progress will be made in agriculture. Do this, and there will be less complaint of young men leaving the farm for the counter.

Nor let the son's education stop here. Although much of practical agriculture may be learned upon the farm, as well or better than elsewhere, yet there are some things that cannot be so learned. To be a farmer in the highest sense, he must have a good general education. I know of no profession or position in life that opens so wide a field for the application of a thorough general education as that of the farmer. He will become somewhat familiar, by his every day business, with branches of geology, mineralogy, chemistry, botany, zoölogy, physiology, ornithology, entomology, meteorology, and other sciences; and the more thorough his knowledge of them, the better able he is to apply their principles to his business. Let me ask, where can the young farmer so well obtain that education as at the Massachusetts Agricultural College, an institution no longer an experiment, but a well-established success, where modern literature and the sciences, as applied to agriculture, are well taught, and at a moderate expense?

The slow growth of agricultural knowledge has proved the necessity of scientific research and a practical experience joining

hands. Neither can do without the other; but both united and working for the same end, can make much greater progress. It is time all jealousies should cease. The scientific man may, from his profound learning, advance theories; but the practical man must work them out, and prove their truth or error. I believe that the Agricultural College, with its noble farm, is especially adapted to bring about this concert of action; and nowhere else can our young farmers so well become acquainted with the results of science applied to farming.

Moreover, I know of no way by which the farmers can be so well and economically protected from unscrupulous manufacturers and vendors of worthless fertilizers, as by having them there honestly and carefully tested, and their real value made known to the community without fear or favor. But few farmers can afford the time and expense for the necessary experiments, or have the ability to conduct them in a way to show fairly the comparative value of such materials. I trust that an especial effort in that direction will be made in that institution, established as it is by the bounty of the United States and of Massachusetts. I think we have a right to expect this work faithfully performed. It would do much to insure continued confidence and future support for the only institution dedicated to the cause of agriculture in the State. Let us therefore give the Massachusetts Agricultural College our encouragement, as I believe great good to our business will grow out of it.

To be a good modern farmer, one must have mechanical skill, in order to manage well the various machines now used on the farm, to enable him to detect and remedy their faults and imperfections as they come from the hands of the inventors and mechanics. It has required years of experience and close observation to bring the plough, the mowing-machine and horse-rake to their present state of perfection. Who but the intelligent farmer that uses them can so well suggest improvements? Scarcely an implement has been introduced that has not thus been improved. The old couplet,—

"He that by the plough would thrive,
Himself must either hold or drive,"

may not be as literally true to-day as when Timothy Pickering took the first premium, at the first ploughing match made by

this society; but it *is* necessary that he should be able to regulate the gauge of the plough, and hitch the team properly, for but very few of the hired men of the present day can do it. If it is *not* necessary for him to do all the work himself, it *is* necessary that he should know *how* to do every part of it, that he may properly direct others.

The farmer, to be most successful, must also be a merchant, and be well booked up in the prices current, and the state and prospect of the market, in the relation of the supply to the demand for his products, in order to know where, when and how to sell them, and also to buy his supplies to the best advantage. The farmer, too, may, when master of his position, like the merchant and manufacturer, employ hired capital in his business, and increase his profits thereby.

Yet, after all, does farming in Essex County pay? It is useless to preach the ennobling influence of the farm upon the human character, the independence of the farmer, or to cite the examples of Cincinnatus, Washington, Jefferson, Webster and others, to stimulate our young men, unless it can be shown that farming in this county pays; for no enterprising New England boy will be contented in a business that does not pay.

I need only to refer to the returns of the income tax to find instances where men by farming alone, have in this county returned annual incomes amounting to from three to five thousand dollars, enough to buy a good farm, with fair buildings. I could name an Essex County farm, of fifty acres, valued at ten thousand dollars, the gross products of which were enough in one year to pay for it. It was an unusual occurrence, but such was the fact for that year. Drive in any direction through the length or breadth of the county, and notice the comfortable homes, the thrifty appearance of the farms, and the contented looks of the occupants. Is the money market tight? they know it not; is gold up or down? it affects them not at all. Do the banks refuse to discount? they care not, so long as they have one of their own in the barnyard, or cellar, that never refuses. Do men lie awake nights, tossing upon restless pillows, wondering wherewith the note, falling due on the morrow, shall be paid? the farmer is not of them. While ninety-six of every hundred who enter mercantile pursuits become bankrupt, the farmer scarce ever does. I have yet to learn of the second in

stance. It is true there are many causes of discouragement to the farmer, some of which are as yet, in the present stage of agricultural knowledge, entirely beyond control, while others, by careful watchfulness, may be easily guarded against.

The canker-worm, has already been spoken of, the borer and caterpillar are the worst enemies of the orchard. The borer can easily be found by his chips, and probed to death with a wire, or limber twig peeled and pointed. The caterpillar's nests are readily seen when the trees first put out their leaves; the nests at that time are small, and a whole colony can be destroyed by a single pinch with the thumb and finger, provided you call upon them at proper hours. Until eight o'clock in the morning, and from twelve to two in the afternoon they are all at home; other parts of every pleasant day they are out foraging, and no man has any excuse for allowing his trees to be eaten by them. The small black fly is very destructive to young cabbage and cucumber plants, frequently destroying the whole crop in a single day. Air-slacked lime or ashes sifted on, are perfect remedies. The striped squash bug and a maggot are very destructive to the squash crop: air-slacked lime or ground plaster is easily applied, inexpensive, and an entire protection against the bug. By planting five seeds in a hill, there will usually be plants enough for the maggot, and two or three plants, besides, to grow, which are sufficient. To insure the seeds coming up readily, they should be stuck in the prepared hill, one inch deep, with the pointed end down; this will save them two days of severe labor in turning over to come up; a labor which in some cases is so difficult as to prevent their coming up at all.

Then we have the onion maggot, an enemy more difficult to deal with, very destructive to the crop in most parts of the country; whole fields are frequently swept away by this pest, and the farmer's hopes with them. By closely watching their habits, it will be found that the onion maggots are the offspring of a small brown fly, that, when startled, will fly about six feet and alight. This fly deposits, either upon the young onion or upon a small lump of earth, from six to twenty eggs, which, within a few days hatch; the very small maggots then appear and immediately go down the young plant to the bottom where the roots branch off from its centre. Here the worm makes an easy entrance to the very heart of the onion, followed by others of different ages, until

one plant contains twenty or more. There they are completely screened from view and all harm, while they eat out the life and substance of one onion, and then pass on to the next. This is their usual habit; sometimes they eat directly through the side of the plant, though not often. They pass through two or three generations during the summer, but the last in the fall, instead of turning to flies, remain in the pupa state during the winter, and all affected onions containing them should be destroyed.

Having learned so much concerning their habits, the question arises, how can our crops be protected? Gas lime and other offensive-smelling substances have been tried in vain, for the mother fly seems to delight in them. For many years my attention has been directed to this subject, and I believe I have discovered a remedy. It is the common practice to cover onion seed one inch deep, and they will germinate better at that depth than any other; nearly all will germinate at two inches, while none will grow if covered three inches deep. I have found that by sowing the seed an inch and a half or two inches deep, the young maggots fail to reach the bottom of the onion, where they expect to make an entrance; and so few attempt it at the side of the plant, that the crop is but little affected. I have tried this method for several years with success; it is important, also, to sow early, and to have the surface of the land highly manured, to give the crop an early and rapid growth in order that the plants may the sooner be too large to be affected by the few maggots that do succeed in making an entrance at the side.

The onion blight and smut, also the potato rot, are at times very destructive to those crops, turning the most promising fields, within a few days, to scenes of desolation. All, in my opinion, are caused by parasitic plants of different varieties, growing upon and consuming the vitality of the onion and potato plants, and in the latter so poisoning the plant as to cause the tuber rapidly to decay. The onion smut, which has more of the character of a fungus plant, so impregnates the land with its spore, as to render it unsafe to plant onions for several years on land thus affected. The parasite that produces the onion white blight does not reproduce itself by seeding the land, but comes upon the crop at the period of its most vigorous growth, in a dry time, showing its effects perhaps in a small spot at first, but in case the dry atmosphere continues, rapidly spreading over the whole field.

Two or three days give sufficient time to stop entirely all future growth of the crop, unless a change in the weather occurs unfavorable to the growth of this parasite. There is another kind of parasite equally destructive, that causes the black blight on the onion crop, similar to that which affects the potato, and requiring the same state of the weather to produce it that is necessary to produce the potato rot. The parasite that causes the potato rot delights in a warm, close, humid atmosphere that frequently follows a rain. When a field of potatoes, planted either early or late, is in its most vigorous growth, just before the tubers begin to ripen, if such a condition of the weather then occurs, this parasite will be produced. The more dense the growth of vines the more liable to an attack, and it will commence in that part of the field where the growth is most vigorous, and will rapidly spread over the whole, unless a change in the weather takes place. Some varieties of potatoes are more susceptible to it than others. If the tops are cut close to the ground, when first attacked, the potatoes may be saved ; otherwise, in a few days, they may become more or less diseased, and decay rapidly follows, in which case it is better to leave the potatoes in the ground until those affected are entirely decayed. A portion of the crop may thus be saved, for if dug before that time the whole will be lost.

It will be seen from what has been said, that if you plant the rows wide apart, or alternate with some other crop, in order to have the vines more open, they will be less liable to an attack.

Many theories have been advanced, from time to time, as to the cause and prevention of these serious hindrances to the farmer's success; but none as yet have proved satisfactory. Every one, however, knows that under certain conditions mould, which is a vegetable growth, will certainly appear ; that on a bank of earth and stable manure, prepared in a certain way, under suitable circumstances, mushrooms will surely grow. A pot of earth placed in midwinter under the drip of a greenhouse, will in a short time produce a very beautiful variety of moss, and in a longer time a second variety will appear. Very many instances of like character might be mentioned, all going to show that certain conditions will produce certain vegetable growths.

I have endeavored to show that certain conditions of the at-

mosphere, at a certain stage of the growth of the onion, and the potato, will produce the parasites that cause the blight and destruction of these crops. I believe that at such times, when the known conditions are favorable for the production of these parasitic plants, some application may be made that would ward off their attacks, and save our crops. Here is a wide field for investigation and experiment worthy the attention of the scientific observer, and practical farmer. Let them work together for effectual remedies of these great evils.

Drought and excessive wet, also, at times operate very much against the farmer's success. The one may be partially remedied by frequent cultivation and hoeing, and the other by a judicious system of under-draining.

How is farming to be made most profitable?

First, let every farmer consider the locality of his farm with reference to the market for his produce; then the character of the soil, and size of the farm; finally his own taste should be carefully studied before deciding upon the kind of farming he will pursue.

Man is capable of governing nations, of commanding armies and navies, of the conception and construction of the most minute and delicate machinery, as well as the most ponderous steamship that ploughs the ocean. He has united the continents, so that the heart-throbbings of the one are felt throughout the length and breadth of the other. He commands the very elements, and they obey, and do his work, but no one man has done all these things, or any two of them. Neither can any one man conduct successfully all kinds of farming; life is not long enough to enable one to become an expert in all.

Darwin, the distinguished naturalist, declares that, "apparently, it transcends the power of the human intellect to breed all kinds of fancy pigeons." How much more difficult for one mind to grasp and manage successfully all kinds of farming.

The farmer having chosen a specialty in accordance with the above principles, let him persevere in it, and he will certainly succeed, take one year with another, provided he pursues a system of high culture. For I know of no kind of good farming that does not pay well; while no kind of poor farming will yield more than a poor living. Nor should it. Of course any man, who is a man and cares for the comfort and happiness of

his family, whatever his specialty may be, will see to it that abundance of vegetables, fruits, small and large, milk, eggs and poultry, are grown upon the farm for family use; for these pay. He will see, also, that a suitable plat be carefully prepared, and that the women and girls of the family be amply provided with the means of stocking it with at least a few choice bedding plants, annual and perennial flowers and shrubs; for these pay.

Does he select the dairy or the raising of milk for the market, let him be sure and test the quality of milk from each cow with a lactometer, and he will be surprised to find how mean some of his animals are. I have recently tested the milk from each of my six cows, and find that the milk of one yields only from one to eight per cent. cream, different milkings varying in quality, while the milk of the others yields from ten to twenty per cent. cream. I had every reason to suppose the first to be a decent cow. But for the trial I might have kept her for years, without knowing what poor milk she gave. Such milk is hardly fit to supply even the Boston market! Test yours. I doubt not many of you have just such cows. The profit in raising milk depends upon the quantity of food a good cow can be made to consume. A poor cow should not be kept, for she affords no profit. Except in the season for pasture or soiling, hay, roots, shorts and Indian meal are fed to advantage in producing milk. Meal should be given sparingly to young cows, lest they be injured by it. Old cows will bear a larger quantity. I once fed ninety bushels of meal to one old cow in one year, at a large profit. She gave twenty quarts per day the whole time, and became very fat for beef. A young cow would have been spoiled by such poor feeding.

If the growing of roots and vegetables be his choice, he should raise his own seed, unless he is sure of getting it of a reliable grower. For whatever may be his cultivation, a poor harvest will be the result of poor seed. The choicest specimens should be carefully selected year after year, that the seed may be *thoroughbred*. For the laws of selection and reversion are just as applicable to the growing of vegetables as to the breeding of animals; and, generally speaking, the laws that govern animal and vegetable life will be found to be wonderfully alike. Therefore let every farmer be sure and use none but thoroughbred seed, and that the centre of the top of all vegetables

selected for seed be uninjured, for the sprout that issues from the centre is the only one that produces the best seed.

The seed from a turnip or a ruta-baga that has had the top cut close, causing thereby the sprouts to issue from the sides, will not produce good roots, but generally tops, with only a tap-root of no value. But turnips designed for late keeping should have the tops pared close, and the tap-root cut off to prevent sprouting, which causes a turnip to become corky. Cabbage seed should never be grown from stumps, but from a sprout issuing from the centre of a perfectly developed head. A medium crop of vegetables, the result of three or four cords of manure per acre, may pay expenses ; but it is the large crops, requiring from seven to twelve cords of well-rotted or composted manure per acre, with clean culture, that afford the profit. Green manure is wholly unfit for the culture of vegetables.

To illustrate the importance of high culture and thoroughbred seed, I will mention an instance that has come under my notice the present season. Mr. David Wentzell, of Salem, has two acres of onions, to which he applied fifteen cords of muscle mud, of the first quality, and twenty-five cords of well-rotted stable manure, measured as thrown lightly into the cart without treading, and probably equal to eighteen cords trodden. He sowed the very best quality of known thoroughbred seed on an acre and three-quarters, then sowed seed grown by a neighbor, of as good quality as the average used ; not having quite enough, he bought more at a seed store to finish the field. All came up equally well. On the part sown with thoroughbred seed there is scarcely an imperfect onion, and the crop is the largest in the vicinity. On the part sown with good seed, the onions are ten days later, of inferior quality and less quantity, and valued at twenty-five per cent. less than the first. On the part sown with seed from the store, (which probably was of about the quality usually in the market,) the onions were still later, of much worse quality and less quantity, and valued at fifty per cent. less than the first. Any one, walking across the field, could tell at a glance and to a row where the different qualities of seed were sown.

Here, then, is an instance where a field of onions, under very high cultivation, was treated, every part, exactly alike, except in the quality of seed sown. The thoroughbred seed yielded

the value of one hundred and fifty bushels per acre more than the average quality of seed generally used by farmers who grow their own, and three hundred bushels per acre more than the average quality of seed sold in the market. This estimate is made while the crop is yet in the field, and six hundred bushels of onions, of the first quality, is not an overestimate of the product per acre from the thoroughbred seed.

I have no doubt that the careful selection for seed year after year, is just as important and profitable in all other vegetable and grain crops as it has shown to be in the case of the onion crop just cited. The raising of seed may be made profitable, provided the grower conscientiously offers none for sale that is not true to description, and of the best thoroughbred quality, grown from selected stock years in succession. A few years of such business would secure a reputation worth a fortune, for such seed will always sell at very high prices.

The growing of small fruits may be made very profitable. The demand for choice fruit at high prices has never been fully met, and it increases every year. As many bushels of berries as of potatoes can be grown upon an acre of land.

Many other branches of the business of farming of equal importance may be treated of, did time permit, that can be pursued with handsome profits, but whatever kind is undertaken, let it be persevered in, for no man, after adapting his land, buildings, stock and tools, to any one kind, can change to another without great loss of time and money.

I know an instance of an industrious and good farmer, who hired a small farm, and made every exertion to prepare it for the onion crop. He grew onions two years and was obliged to sell them from a dollar and a quarter to two dollars per barrel, while early potatoes brought high prices and paid large profits. The next two years he planted early potatoes, excluded onions, but unfortunately for him, potatoes rotted badly both years, and onions were sold from three to eight dollars per barrel. If he had continued his onion crop, his returns would have been large.

In another case, a neighbor cultivated onions, and for three years his crops were partial failures, causing him to fall in debt five hundred dollars each year, but he persisted in their cultivation, and the fourth year he was enabled to pay off his debt of the previous three years, and clear two thousand dollars besides,

whereas, if he had changed his system of farming, he might never have paid his debt, and farming, in his case, would have been a failure, instead of the great success it has since proved to be.

Having thus given you some of the results of my experience and observation as a practical farmer, born and bred in our good old county, and knowing, too, the resources of her soil, if but wisely and thoroughly cultivated, let me, in conclusion, urge you to renewed efforts in developing those resources by premiums, by shows, by the publication of reports and essays, by using all means to draw out *truthful* statements of experience, by disseminating knowledge of high farming, and by living up to the knowledge you possess, and practising what you preach to others, until every farmer, belonging to this society, makes his farming not only pay, but yield handsome returns for his industry.

LEGISLATIVE AIDS TO AGRICULTURE.

From an Address before the Worcester Agricultural Society.

BY BENJAMIN F. BUTLER.

No intelligent mind can have failed to observe the great movements of collision of labor and capital that now agitate every free country. Trades' unions combine the skilled labor of the British empire; labor unions organize the mechanics of this country; and strikes, the organized demand of labor for concessions from capital, are the exhibitions of the perennial contest between the two, ever common in almost every department of toil. And it is also to be noted that while, as a rule, heretofore, capital has been successful in every one of these contests, it is a remarkable fact that at this juncture the strikes of the artisan and mechanic, after more or less protracted struggle, have won. Another suggestive fact, is that none of these strikes or collisions has yet taken place in farm labor, nor has such labor been affected by them, save in degree as the wages of labor more or less skilled have been thereby raised. What is the explanation of this, taken in connection with the fact that tilling the land employs rather more than three-fourths of all the able-bodied men of the country?

To answer this question will require us to devote a moment to the examination of the causes and objects of these collisions of labor and capital.

No one can doubt that in all mechanical and manufacturing industries the production, or, more strictly speaking, the capability of production, has increased tenfold within the last fifty years. The application of the steam-engine as a motive power, the improvements in machinery in the production of every manufactured necessary and nearly every luxury of life, have so cheapened their cost as to convert many luxuries into necessi-

ties. The facilities of transportation have brought the comforts of life to every man's hearth, and of course, following so great increase of production, has come a corresponding increase of profits to the producer on that production. Now, if with the profits on the products of mechanics and manufactures by manual labor solely, or aided by rude machinery, it required—as a half century ago it did—the laborer to work from twelve to fourteen hours a day to obtain the ordinary means of subsistence, it would seem that, with this great increase of production from his labor, aided by more perfect machinery, he might be able to obtain the same means of comfortable subsistence, especially as they are cheapened by this very facility of production, with at least half as many hours; or, if working more hours, he should obtain greater rewards for his industry, so as soon to place him beyond the necessity of labor. But while in many cases it is true that the workman has become the master-mechanic, employing others, and has thereby obtained comfort and independence, and in a great measure wealth, yet it is impossible not to see that the condition of the mass of workmen is not much advanced; and these cases of the bettered condition of the master-workmen have come, not from the improved price of their own labor, but from their ability to employ and take the profit of the labor of others; while we see the dividends or rewards which the capitalist or employer has received from this increase of manufacturing or mechanical production have created vast fortunes and enormous aggregations of wealth.

Hence we may infer, with logical accuracy, that there is not yet a fair division of the profits of mechanical and manufacturing labor between the capitalists and the workmen. The capitalist, as a rule, grows rich; the workman grows only a little more comfortable; and that comfort comes because he is enabled, from the very production of his labor, to buy some of the comforts of life at less prices in comparison with the wages he receives.

Now there are two ways in which an equal division of profits from the union of capital and industry can be made; one, in giving a higher price for labor, so that the workman would not be obliged to be employed so long to obtain the means of a livelihood; and the other is by shortening the hours daily which he works for the same pay, to wit, the means of obtaining a

livelihood. Therefore the struggle is now going on, not only in this country, but abroad, in both directions, for such equal division. On the one side, workmen are insisting that they shall have more pay; on the other hand, other workmen are insisting that they shall work less hours for the same pay, which is another mode of arriving at the same result.

At this hour, and upon this occasion, it may not be profitable to discuss this question, which soon will tax, for its proper adjustment, the best statesmanship and highest humanity and justice of the country. It will not be ignored. If the laboring man has improved in no great degree in anything else, he has become fully aware of his situation, his powers and his capabilities, and will not long suffer what he deems to be an injustice, however it may be guarded by legal enactment. He has learned and is still learning that with himself resides the power by the ballot to repeal those laws, and substitute others in his own favor in their stead; and the danger is that he may not stop in that change at the precise limit of justice on his side. Here he is not limited to strikes and combinations, as in the old world, in the pursuit of his rights. In this country he is the law-making power itself. I have thus only adverted to the actual state of things, to aid us in considering its relations and effects upon agricultural labors.

It must be first considered that there is a lack of increase in the capacity for production of the land within the last half century, as compared with the increase of production in everything which goes to make the necessaries of life coming from manufactures and the arts. True, the machine-reaper, mower, thresher and rake have aided, in some degree, the labor of the farmer; but it cannot fail to be observed that almost all the improvements of agricultural machinery only aid him to gather the results of his toil, but do not make a spire of grass or blade of corn grow where there was not one before. The plough is the same with which your fathers broke the furrow; the hoe, the shovel, the spade, are the same. The cultivator and like contrivances have lightened, in some degree, your labors, but only in the thousandth part of a degree as compared with the production of the power-loom over the loom of a half century since.

Therefore it is that there has been, and from the nature of

things can be, no strike by the farm laborer for a larger share of the profits of farming, for there are no great profits to divide. The farm laborer does not ask to shorten his hours of labor, because with those hours shortened his capacity for production would not keep him from starvation. He does not combine to make the farmer pay greater wages, because any substantial increase of price would render employment of labor in farming quite impossible. Because of this want of increase of production on the farm comes the well-known fact that the profits from agricultural labor are the least of any department of human industry. The discoveries of chemistry, the inventions of science have aided it in a degree ; but still comes back to the farmer the normal and primeval condition that " in the sweat of thy face "—(not by the labor of the steam-engine,)—" shalt thou eat thy bread." The profits of investment of capital in farming and of labor on the farm are but little advanced from what they were at the beginning of the century.

I by no means mean to say that farm wages have not risen, but they have risen because of the high prices paid in manufacturing, mechanical and commercial pursuits, and the higher rewards to be obtained by the investment and employment of capital in such pursuits. Hence it is that all our boys leave the farm to go into other business, hardly one remaining to take care of the homestead ; and hence it is that the father encourages the boy to leave the farm to become the broker, the banker, the merchant or the manufacturer—aye, and, too often, endorses a note or mortgages the farm to raise the capital with which the boy is to start in business. As the records of mercantile and banking pursuits show that only one in a hundred is in a high degree successful, if the boy is unfortunate, then the old homestead goes, and the father and the mother totter down to their graves in helpless poverty, oppressed by the thought that they have been ruined by the darling son, whose haste to be rich they themselves have quickened and urged.

There is another, but perhaps minor, reason to be considered in learning the causes why there are among the farm laborers no strikes or trades' unions by which an increase of price is demanded or a diminution of the hours of labor sought. For, although during the few months of seed-time and harvest, wages of farm labor are very considerable, yet during the other seasons

of the year there is a corresponding reduction which makes the average quite low. Is not this cause found in the fact that, as a rule, the farm laborer, both male and female, is furnished with subsistence by the farmer? The mechanic in the village or city finds that his wages will not provide meat and bread for his wife, himself and little ones, and especially when are added the wants that the village and city seem to bring up as necessaries of life, and therefore he strikes for more pay. But the laborer boarding at the farmer's table is indifferent to the price of meat; that, in his mind, affects the farmer alone. He is to have so much per day or week or month and be "found," and he has therefore but little concern with the price of flour or the quotations of the Brighton market. So that, in this way, the farmer may be said to pay high wages, because, in fact, all that the workman has as wages in any employment is the surplus after providing for his subsistence, and the farm laborer subsisted by the farmer is likely to find a larger surplus at the end of the season than the mechanic who shall have had nominally one-third or one-half more.

Another reason why agricultural production has not increased in the same ratio with that of other branches of industry is, that it is impossible, in the nature of things, to apply to it, in any considerable degree, the great power of association of capital which is so successful in every other department of life. Up to a certain limit only is capital of any use to enhance the profits of farming. It may and does beautify the farm. It may and does make it blossom as a rose. But capital rarely, if ever, finds any reward in what has come to be known among practical men as "fancy farming." No association of men have ever undertaken to aggregate their capital for the purpose of increasing the profits of agriculture. No association of men have ever tried upon the farm even the co-operative system of labor, if we except a few enthusiasts for religious purposes; and even those with indifferent success, save when they have worked small manufactories in connection with their farming pursuits. No Act of incorporation was ever asked or granted by the legislature to raise corn, or wheat, or potatoes. Therefore it is, that while every other human pursuit has been aided by association, and very largely by direct legislation, nothing has been or can be done by law specifically to aid the farmer, or generally, except to protect him, his property, his earnings and his rights; but

much has been done under the forms of law to injure and depress agricultural pursuits.

Starting with the thesis—as we must do—that all the actual means of subsistence to man must come out of the earth at first, and that all the other pursuits are only to add to his comforts and luxury, or to obtain to the individual more than an equal share of such comforts and luxuries, and then comparing the legal and mechanical machinery which has been devised to assist those other pursuits, it will be seen at once why agricultural production has not been in greater degree increased, and is with us among the least remunerative of employments.

Nothing more forcibly illustrates this than a glance at the aids which other occupations receive from legislative action.

In no spirit of criticism—certainly none of detraction—but by a simple grouping of facts, by way of illustration, let us compare the aids given by legislation to agriculture with those afforded to other pursuits. And that we may bring it to the test of our recent memories, perhaps it may be as well to take the legislation of our own State and in the present year, as any other; for we in Massachusetts hold, with reasonable pride, that our laws are models, and that our legislatures are uncorrupt and incorruptible.

At the time I was considering the topics of my address, there was put into my hands a book of over five hundred octavo printed pages, containing the laws passed by the legislature of the Commonwealth in 1869. "Five hundred octavo pages of law," said I, "in a single year. Five thousand in ten years, and ten thousand in twenty years, for a single State." The world itself will not contain the laws that shall pass in a few generations! In a note at the end we are told that the "General Court of 1869" assembled on Wednesday, the 6th day of January, and was prorogued on Thursday, the 24th day of June, the session having occupied one hundred and seventy days; that they passed 466 Acts and 103 Resolves, all of which had received the approval of the governor; and then, not without a touch of grave humor, we are informed that the Acts may be classified as follows:—General statutes, or acts of a public character, 293; special Acts, relating to individuals and corporations, 173. The Resolves do not seem to have been classified at all, although they were, with perhaps two exceptions, in favor of individuals, and

with almost only the same exceptions, each one took money from the treasury of the State raised by taxation. Led to examine how many of these 569 Acts and Resolves were in the index under the head of agriculture, I found there one only, the indexical words of which are, "Agriculture, Board of, secretary may employ a clerk," and the Act provides for expending for clerical services, and for lectures, to be given before the Board of Agriculture, the sum of fourteen hundred dollars. What! one Act only out of nearly six hundred, to promote agriculture, which must yet be reckoned as the greatest single industrial interest of the State; and the munificent sum of fourteen hundred dollars to be expended for a clerk and lectures to the Board of Agriculture. Why, that law and that money so expended will not raise a single potato or suckle a single calf in the State—always excepting the clerk who may be hereafter appointed under it. It is fair, however, to the law-making power to say that they passed a Resolution appropriating the sum of $50,000 to the Massachusetts Agricultural College for the erection of buildings and the improvement of the same; and they also repealed a section of a former act which allows each agricultural society, under certain restrictions, to send a delegate to the State Board of Agriculture.

This is all the aid, direct and indirect, that the farming interest of Massachusetts received from the legislature of 1869.

"What, one pennyworth of bread only to all this sack!"

The direct expenditure in behalf of agriculture, $1,400! while $7,000, in addition to $8,000 heretofore appropriated, was in the same year appropriated for the purpose of re-publishing the "History of the Invertebrate Animals of Massachusetts," which being interpreted is the history of animals lacking backbone. I by no means wish to urge that this expenditure was unnecessary, partly because, although that kind of animal is not confined to Massachusetts, yet as it is supposed that the politicians are generally included in that class, so therefore the republication of such history might have become a sort of State necessity. Still, I think the farmers may well compare the expenditure authorized in one case with that appropriated for the other.

While we have but three Acts, in fact, touching agriculture in

any form, we cannot help but compare that number with one hundred and sixty-two Acts directly or indirectly concerning railways and railway corporations; thirty-seven Acts for banks and banking institutions; nine Acts incorporating manufacturing companies—each one of which might as well have organized under the general law; nine Acts incorporating insurance companies; and seventeen Acts of appropriations for an expenditure of $3,773,000; and the loan of five millions of the State bonds to a single railroad, a portion only of the line of which was in our limits, the stock of which is not worth a shilling on the dollar in market.

I do not mean to be understood that the legislature of 1869 was worse or better than former legislatures—it was quite as good as any other. I am commenting on the system of legislation which fosters every other interest at the expense of the agricultural interest and at the expense of labor in every department of industry, if in no other way, because taxes at last come with the heaviest burden upon land and the products and stock of the farm, for they cannot be concealed. Capital may be locked up in insurance companies, covered up under mortgages, hidden in bonds, absorbed in a thousand ways of surpluses and bonuses and extra dividends which do never reach the assessor's eye, and in manners which may salve the conscience of its owners; but the farm, the ox, the horse, the cow, the pig, and the sheep, are always open to the tax-gatherer.

For what purpose, as a rule—and that, too, hardly without exception—does any one desire a special Act of legislation in his favor? Is it not that he may give some advantage to himself, some power, some right, something over and beyond what his neighbor has? No set of men ask for an Act of incorporation, whether to manufacture, for a railroad, for a telegraph, for a bridge, for a bank, for a trust company, for a deposit company, or for a savings bank even, out of pure and unmixed benevolence and philanthropy, but with the expectation to make thereby more money than they can get by any simple, honest toil. And whenever one man is given an advantage of his neighbor by the law, then an injustice and wrong is done to that neighbor. And whenever capital combines itself, it is for the purpose of assuring and strengthening itself and increasing itself more than can be done without such combination. And whenever capital

gets an undue return for its investments, that return must come either from an undue extension of the hours of labor or the unduly depressed price of wages in some department of human industry. And whenever taxation is authorized by law for the benefit of the few to be taken from the earnings of the many, then that legislation is unjust and oppressive, and ought to be abrogated, whether the laws are the enactments of a republic or the decrees of an empire.

Why is it that in this State of ours, containing less than a million and a half of inhabitants, and less than eight thousand square miles, one hundred and seventy days of a year—and not that for a single year, but nearly that time in every year—must be taken up for legislation,—a longer time than is taken by the Congress of the United States in legislating for a country containing more than three millions of square miles, with eleven thousand miles of boundary, and forty millions of people, with all their varied interests and relations, domestic and foreign? And I by no means set up Congress as a pattern, either of celerity or accuracy of legislation. The reason is that nine-tenths of all our legislation are for private objects, and to give private advantages to somebody over somebody else, or to meet special cases only. True, it is said by the compiler of the Acts of the legislature, that the largest portion of them are general laws; but of what kind? Most of them might as well not have been passed; some are changes and alterations, but not betterments; many are passed without discussion, without being understood, and without thought. In proof of which I can point to Act upon Act passed at the same session to make the first either operative or intelligible. In proof that the legislature is most of the time engaged in the discussion of private and not general laws, let me cite the fact that the committees which sit the longest and work the most laboriously—and no one is more ready to accord them industry and ability than myself—are those that hear the petitions of private individuals for private Acts for their own proper benefit. Take for example the committees on railways and manufactures and banks and banking.

You may think my strictures upon what are called general laws are too sweeping and too stringent. But take some examples of the so-called general laws. Every Act affecting in any degree, however minute, the public, is classified as a general

law. All Acts affecting highways, all Acts affecting schools or school children, are said to be general laws. Let us take one for example. It provides that "any town may raise money in taxes or otherwise, to be expended by the school committee in providing for the conveyance of pupils to and from public schools." In our day we walked, some of us, miles to and from school, and were all the better for the exercise. Our mothers walked to school. The ruddy glow of health, the invigorated constitution, made them the happy mothers of families of numerous children. Their driven-in-a-carriage-to-school granddaughters, if we may believe one of the most learned and laborious of our physicians, are becoming physically incapable of perpetuating the race of New England men!

It is somewhat difficult to classify the "Act to prevent the taking of trout in Avery Brook, within the limits of the towns of Charlemont or Heath, without a written license from the owners or lessees." At first thought, one would suppose that a private Act; but when the taking of the trout is made a crime, to be recovered by complaint or indictment in the name of the Commonwealth, it would seem sufficiently to interest the public to be classed as a public one. Again, one would have thought that the Act concerning the manufacture and sale of intoxicating liquors had been sufficiently discussed and examined not to require supplemental legislation at the same session of its passage; and yet, within three days thereafter, we are told, by grave enactment of public law, that the word "constable, wherever it occurs in chapter 415 in the Acts of the present year, shall be construed to mean the constable of the Commonwealth and his deputies." Why not have said so in the original Act, as everybody knew that it was substantially to be enforced by those officers?

Agriculture asks for no special legislation. It is not benefited by any legislation whatever, except such as shall preserve the morals of the people and the rights of property and person. Indeed, the best legislation to aid the tilling of the earth is that which lets it most severely alone. But what ought to be complained of is the fostering of every interest by special laws, giving to them every power that law can give to association and combination—all interests save *one*. Looking through this large volume of Acts, we find no Act in aid of labor, or authorizing

any association of labor. We do find acts authorizing benevolent and charitable associations, religious and educational associations, temperance associations; and we have seen every possible form of association of capital, and at last an Act of corporation of men to take the moneys paid into the courts in progress of litigation or bequeathed in trust for widows and orphans, for their benefit, and to be held and invested—does any one believe without fee and reward? Are not the funds, in fact, to be held and invested for the use and benefit of the corporators, who are to make a profit therefrom? Everywhere, under every conceivable state of facts, legislation has been invoked to aid men to get a living in some other way than by honest toil. But we look in vain for any Act passed to organize or associate, or give the power or benefit of organization or association to, any form of labor, whether mechanical, manufacturing or agricultural.

We have already seen that agricultural labor may not be benefited by association; but it by no means follows that manufacturing and mechanical labor might not be so. Remembering current history, we know that a large and numerous body of mechanics thought best to associate themselves together for mutual protection against the demands of capital, and that an Act incorporating that association was refused by the legislature. A half a thousand Acts to protect capital passed; but one asked for, and that refused, to protect labor!

I do not now desire to discuss the question whether the details of the manner and objects of the association of laborers which was asked to be incorporated were correct and just or not. I have heard them severely criticised. It is said that they proposed by their association to prevent the master-workmen in their craft from employing such hands as they wished. That may be very wrong. Its rights or wrongs we will not now consider. But I cannot forget, having lived in a manufacturing city, man and boy, for more than forty years, that the incorporated manufacturing companies have had in operation a rule there,—and I believe a similar one exists in other parts of the State,—by which no operative leaving employment in one mill, unless he or she received a permit from the overseer under whom their labor had been performed, could be employed in any other mill in the same city. And this, too, without any

regard to the cause which induced the desire to change the employment. And yet I have never heard of any attempt by any legislature to take away the charter of any incorporated company because of this rule, the converse of which seems to be so fatal an objection to the incorporation of a labor association.

Nearly twenty years ago, a woman called upon me for counsel who had faithfully done her duty in every way and form, having labored as an operative of one of the Lowell companies for more than a year. Having a helpless mother dependent upon her, she chose to change the place of her employment, and having given a fortnight's notice of her intention so to do, a proper discharge was refused by her overseer without any reason, because, when she applied for her "line," he refused it, although he said she might return and work for him. She had applied to every one of the eleven or twelve incorporated manufacturing companies in Lowell, and was, under that rule, refused employment. It occurred to me, that, as that certificate was so valuable, if she had faithfully performed her duty, she certainly ought to have a right to it; that no one could inflict that amount of damage upon her causelessly without legal remedy; and therefore I brought the corporation before the courts, demanding of them to show cause, other than the simple despotic exercise of their own will, why they did not give her such honorable discharge. But the court, as a question of law, upheld the manufacturing company in the exercise of this prerogative, and the girl was thus deprived, without her fault, and without redress even, of the privilege of labor by which to earn the support of herself and helpless mother. The case is in the Massachusetts reports; you may read it there as the law of the Commonwealth. And yet the petition of the workingmen to associate themselves for defence against this arbitrary power of the employer, and to establish a like rule for themselves, was refused a hearing in the legislature of Massachusetts! and by the votes of men belonging to both political parties; so that the questions we are discussing may be taken out of the arena of party politics.

I have already demonstrated that the farmer cannot be helped by legislation. What he should demand is that he should not be impeded by legislation. Every law which permits or assists

any individual of society to get his living without labor, is a tax direct, inevitable and oppressive, upon the laboring interest of the community, and is an injustice to every laborer and every farmer. This system of special legislation, which has grown up until it takes the legislature six months in the year to pass laws to guide the State for the other six months, has come to be an evil, to alleviate, aye, to eradicate which, I call upon the only disinterested body of men—the farmers of Massachusetts—to interpose.

In reply to these suggestions, I may be answered—as it is the stock reply of those asking special legislation, that incorporating railroads and aiding means of transportation of persons and products are of equal advantage to the agricultural interest with that of any other—that the special legislation of which I have complained has built up a system of railroads over the State which has largely conduced to its prosperity. A large part of this may be admitted to be true, and yet it is no answer to our argument. The legislation which has built railroads, from which capital and capitalists may realize large dividends and immense fortunes, may and does indeed benefit the State, but at a very enormous expense to the tax-payer and producer. Dividends of ten or fifteen per cent., railroad stocks increasing from par to one hundred and fifty per cent., are only to be sustained by rates of fare which are burdensome and oppressive to those needing the means of cheap transportation to get their produce to market. And is it not a fact, that the railroads find it for their interest so to manage their affairs and to adjust their tariff of charges as to favor the long lines of transportation,—thus to entice the wheat and flour and corn of the West to come to Boston for shipment, and not to New York,—rather than in favor of the local agricultural interests of Massachusetts?

Again, the undertaking of one of the most gigantic engineering enterprises of the age—the boring of a tunnel five miles through a mountain—is not, if I understand it, although the millions requisite for the accomplishment of the object are to come from taxation, intended to build up the local interests of Massachusetts farmers, but is to make a through line to the great West in the interests of capital invested in the banking, mercantile and manufacturing pursuits of the State. Railroads have now become the actual common highways of the country,

and should be managed for the benefit of the people thereof, and not, as now, for the benefit of the few having them in charge, and scarcely even in behalf of the stockholders. We are not complaining of railroads; we are not complaining of business enterprises; but we are complaining of those laws and that theory of law-making which gives one man an advantage over others.

Let us take an illustration. It is said there is a gentleman in a neighboring State, who at twenty-one, was employed in conveying passengers with a single pair of oars from New Jersey to New York, who, by his enterprise—by taking advantage of the laws regulating the means of transportation of passengers and merchandise—at the age of threescore and ten has accumulated as many millions of dollars. Now we do not object to the enterprise, the industry and energy which can accumulate so much; but what we do object to is, that the laws regulating what has become a prime necessity of life—the transportation of food and merchandise and the person—the common highways of the people, by land and by sea, can be so manipulated that any man in a single lifetime, by any means, can accumulate such a fortune. He cannot have made so great a mass of wealth without taking from others what should have been by them enjoyed. In other words, he has got more, much more than his share, giving credit for all the ability he possesses. He may not be blamable in having acquired so much; but what shall we say of the laws which in a country of equal rights, and therefore of what should be equal laws, will make it possible for one man so to overtop all others in wealth, which must be produced by labor from the earth at last?

When our fathers abolished primogeniture and entail by constitutional enactment, they proposed that the law should require such frequent distributions of property, through the death of the holder, that no man could get inordinately rich. They saw in the old world that the immense riches which made an aristocracy of wealth arose from continued accumulations in a single family, guarded from distribution by law. They assumed that in a single lifetime great accumulations would be impossible, however successful or however enterprising a man might be. That was true in their generation. In 1799 two men died—the great farmer of the country, George Washington, and the great

merchant of the country, E. Hasket Derby, of Massachusetts. The fortune of the merchant was nine hundred thousand dollars, and of the farmer seven hundred thousand dollars; and those were the very largest fortunes of that day, obtained under the most advantageous circumstances. But now, by manipulation of stocks; by taxing the productions of agriculture in their transit from the farm to the market; by employing men in large numbers to work and taking the profits of their labor in manufacturing; by taking advantage of or evading the laws relating to the importation of merchandise; by evading the internal taxation which the wants of the country imposed; by loaning the money received from the government without interest at enormous profits—nay, by buying and selling the indebtment of the nation itself; by subsidies and grants of special privileges by law; by the power of association of capital under the forms of laws; by any and every way except hard labor, we see many hundreds, aye thousands, of colossal fortunes such as in other countries and in other times were only the result of the long-continued nurture of wealth locked up in single families for generations. Indeed, all special legislation tends to make the rich richer, and necessarily, by comparison, the poor poorer.

In fact, our system of incorporated wealth has brought back the laws of entail and primogeniture with all their most odious features. The property of a husband invested in the stocks of a corporation bars the widow of her dower, and enables the father, because his property is in stocks which are under the care and perpetual direction of others, to give a fortune to an imbecile son, which, without these legal provisions—which keep it productive for his use—would have been distributed in the community by his follies or dissipation.

Our legislative Acts of association give another advantage to capitalists and to the accumulation of wealth which the laws of primogeniture and entail never did. They so aggregate capital that it can escape the eye of the tax gatherer, whether State or national, and thus work a practical inequality and injustice in taxation. While we boast—and the boast is true if the laws could be honestly and efficiently administered—that all taxation is equal, yet, as we have before seen, the land and farm stock lie out under the eye, while moneyed capital, by the very provi-

sions of the laws which aggregate it, conceals itself in a thousand forms so as to be wholly beyond the reach of taxation.

This state of things has not yet gone past remedy. Let us take timely warning. Let us examine carefully into the evils of this system of legislation. Let us reform them altogether. One means of preventing too much legislation would be meetings of the legislature once in two or four years only. We have a system of general laws, come down from our fathers, with all their wisdom perfected now through more than eighty years of careful revision, ample for all the general wants of the people; ample to punish crime, to determine rights, to protect person and preserve property; ample for all purposes for which laws are good. Why is it, then, that we should spend so much time in making others, or rather in doing those legislative Acts which are only the means of private advancement? Many years ago, the excuse for Acts of incorporation was that there was not sufficient capital in the hands of individuals to enable the undertaking of large industrial enterprises, and therefore it was necessary to associate the means of many for such purposes. Now, as we have seen, there are accumulations of individual wealth sufficient for all purposes—many and many individuals carrying on larger industrial enterprises than any corporation; so that that reason failing, what can be said why the making of corporations should not stop? Are they now anything more than means by which people can associate together to commence enterprises of which, if successful, they reap the benefit, and if lost or unproductive, by getting rid of individual responsibility, throw the burden of the failure upon innocent persons, and generally upon the industrial classes?

While true it is that agriculture has all its discouragements and all its difficulties, and that it never can be the most lucrative employment of men, yet the tillage of the land will ever be the favorite one. Nearly all men in professional or mercantile or manufacturing life look forward, as the end and object and finish of their exertions, to a time when they may leave the turmoil of business and find the tranquil delights of old age in the culture of the land. To become farmers, in fact, is the end of all their aspirations, of all their endeavors, of all their enterprises. The shipmaster who ploughs every ocean, visits every country, observes the fertility of every soil, tastes of the fruits of the tropical clime,

wanders amid the monuments of grandeur and civilization of the old world, still at last returns to the cultivation of the lands, even the sands of Cape Cod. It seems the yearning desire of the human heart to return to the bosom of mother earth. Well may it be so; for to the purifying and revivifying influence of the farm and the country, we owe most that is stable in government, most that is patriotic in thought and loyal in endeavor. The battles for the Union in the late rebellion were fought in a great degree by the farmer boys of the country. A majority of those that went forth at the first call left the plough in the furrow or dropped the shovel or spade in the garden. The corruptions, the vices of cities have so far not reached the land; and to the country the statesman must look for stability and safety and purity of the laws. There is a reason why this must be so. In the country there is time for reflection, time for thought. In the city, amid the whirl and turmoil of the clashing pursuits of aggregated men, there is time only for the perceptions. In the city, man lives guided by his eyes and his senses; in the country he lives in his reflections and ideas. The occupation of tilling the farm, I need not say to you, gives health and strength to the body as well as purity to the mind. Whoever, tilling the soil, is inclined to look with envy upon the successes of his neighbor in the accumulation of wealth, let him console himself with the remembrance that at last that neighbor will yearn to return to the soil again to till it, and in it to find his last resting-place.

5*

PLANT LIFE.

From an Address before the Union Agricultural Society.

BY ELIPHALET STONE.

The world is full of beauty, and the mind of man is sufficient to analyze and bring it out. Let him think and work, and his existence here will be no problem. He will become a creator himself, and will create and surround himself with a new world —a world of beauty and utility.

Nature is a perfect laboratory. Her curious chemistry is full of interest and instruction to the farmer. The sciences applicable to agriculture are the keys to the hidden mysteries. These sciences develop the true order of nature through all the successive stages of mineral, vegetable and animal forms, reducing the vegetable creation back to its mineral elements, out of which, through the agency of subtle and mysterious laws, the wonders of the vegetable world have been elaborated; and further tracing the evolution of the animal kingdom from the vegetable, to which it is so closely related as to seem to be a regular outgrowth of it, until at last we reach man,—the crown, the consummate flower of all,—with that infinitely higher principle of God himself, and the whole a mighty illustration of Divine power and wisdom. Nature never works but for an object, and that object is the reproduction of its species; and nothing is perfect that does not possess within itself this reproductive power, in whole or in part.

We look upon the beautiful flowers and fruit as sent by a Divine providence for our benefit and pleasure, and so we should consider them; for as man is the great master-piece of creation, all other things must be regarded with reference to him. But the flower and the fruit have another object in view, and that object is the reproduction of themselves. Sir Humphrey Davy

says: "It appears throughout nature that the efforts of a plant, from its first establishment, are directed to acquire the proper state and condition to propagate its species, and that in its seed and fruit is comprised its concentrated essence. We may therefore estimate its powers and efforts to be in proportion to its wants."

The general functions of animals and vegetables are in most respects similar, and the operations of nature regarding both are regulated by much the same laws. Most likely the different species only of animals and vegetables were at first created, and that the different varieties which we now observe were caused by differences in climate, food and shelter. The same intercourse is necessary to both for the purpose of reproduction. We have the same control over the process of fertilization in plants as we have over the mixture of breeds in animals, and are thus enabled to produce varieties at will, although there is a point beyond which nature revolts. Nature provides for the propagation of plants in different ways, but generally by seed. Some are raised by setting a part of the root in the ground, others by offsets, and others again by cuttings, and others by grafting and budding. Nature is prolific, but never prodigal. She always holds in reserve the power to reproduce in case of failure of the seed. We look upon the tree when in leaf and flower with admiration, and yet how few ever realize the relation of the leaf to the parent tree; how few realize that the leaves are the lungs of the tree, and that the tree could not sustain life long without them; that it is through the instrumentality of the leaf that the tree or vegetable obtains its food, drawing from the earth those substances there distilled, and from the air various elements, which, combined, make the perfect food of the plant, throwing off into the atmosphere all impure substances not required for its purpose, and then dispensing the prepared food for the growth of the tree and the maturing of the fruit. Cut a twig from any tree you please, and let us examine the leaf and see what other office it holds besides that of caterer to the appetite of the parent tree. What is this little casket at the foot of the leaf-stalk? Be very careful now, for the little bud contains the future hopes of the tree. Within are the leaf and flower for the coming year, the embryo or germ, containing all the elements of a perfect tree within itself.

During all the time that this leaf has been so busily at work for the tree itself, it has been nursing the little bud which is to be the leaf's successor in office during the coming year. When the bud is matured sufficiently, and is secured with a covering so nicely arranged that the cold and moisture of the coming winter cannot injure it, then the leaf has performed its mission and falls to the ground, and still further contributes, by its own decay, to the growth of the parent tree. What a wonderful mechanism is here! A tree may have a hundred thousand leaves, yet every leaf has the same functions to perform. What a grand illustration of Divine power and intelligence!

But in order to carry out our idea, we must still follow the history of our little *protegé*—the bud. The leaf has now left the bud to the kind care of the tree, which, by its juices, feeds it through the late autumn and winter, and prepares it for the important duties it must perform during the coming season, (for the active force of the tree continues to a certain extent through the winter.) Spring comes, and kindly kisses the little bud, and lo! it bursts forth into the glory of leaf and flower. And now another agency—a wise provision of Providence—interposes to begin the work of fertilization. The gentle breeze scatters with its wings the seminal dust or pollen in the greatest profusion over the whole vegetable creation, or the busy bee,

> "That wanders all day long,
> Sipping the sweet from every flower,"

bears with her the vitalizing atoms from flower to flower, taking nectar in exchange, and bearing it away.

Our little flower now drops its petals and goes on rejoicing, making haste for "coming events." The tiny leaf, born with the flower to be its companion, is now called upon to furnish suitable food for the infant fruit, which grows and thrives upon its simple diet until it nearly reaches its full size. It is now time to mature and perfect the seed, the crowning object of its existence. All the rich juices of the tree, the work of the year, are brought forward to attain this one object of all its efforts. That done, it puts on the finishing touches by flavoring and coloring, and the fruit is ripe, and the tree's mission, for the season, is ended.

For the better illustration of this principle, we will take the

apple. You have seen the great labor of the mother tree in perfecting this vital principle in the seed. She has exhausted all her strength; still, in her economy, she has all this time been preparing another set of fruit-buds for the coming season, but she has not strength enough left to mature them properly. All her efforts are now required to recuperate her own energies; therefore the original purpose of these buds must be altered; their mission must be changed; and they are consequently transformed from fruit to leaf-buds. Had the tree been relieved from the necessity of maturing her large crop by thinning—taking out the imperfect fruit—the balance would have been worth more than the whole now is, and the tree would have been in condition to have matured her fruit-buds, and produced another crop of fruit the next season; for, like the mother who bestows extra care on her deformed child, the tree gives as much care to the imperfect as to the perfect fruit; it is the seed only that is the object of her solicitude and attention.

This principle runs through all nature, and from it we may learn a lesson.

Take the grass, for example. Much has been said and much has been written on the subject, and much good, I am satisfied, has and will come out of the discussion. This much only I wish to say, that I believe the proper time to cut grass for the barn to be when the grasses are in the milk, just before the maturing of the seed begins. It is then that the stalk holds all the properties which are so nutritious for animal food. Let the juices become absorbed in the maturing of the seed, and you will find but little nutriment left in the stalk, nearly all having passed into the seed, and still you will not find all its virtues in the seed. A transformation has taken place; the element of sugar has disappeared, and starch is the principal property left.

But there are other important considerations to be taken into account. By cutting the grass before the exhausting process of maturing the seed takes place, you save the vitality of the grass roots for a second crop; for the moment nature is defeated in her object of maturing the seed, she goes immediately to work to retrieve her misfortune by throwing up new stalks and flowers, which, being treated as before, crop after crop may thus be taken without exhausting the soil as much as the maturing of one crop of perfect seed. The ladies may, from this fact, learn

an important lesson in the cultivation of flowers. A plant will not exhaust itself as much in making a dozen flowers as in maturing one seed-pod. After flowering, nip off the pod.

But to return to the bud. I wish to give you another example of the workings of nature in the propagation of varieties of the same species. I told you that the bud contained all the elements of the perfect tree within itself; and to show the power of the bud to transform the roots of the seedling plant when budded into it, I will relate the process of budding the apple. In order to propagate a particular variety, we nurserymen are in the habit of taking the seedling stock, at the age of one or two years, and inserting the bud near the ground, say three or four inches above the root. This must be done while the stock is in the growing state, so that the bark will readily part from the sap-wood. If the bud and stock are both in a proper condition, the bud will soon adhere and grow to the sap-wood. The next spring, when the stock quickens, we cut off the stock just above the bud. This throws the force of the ascending sap into the bud, and it starts into vigorous growth, often growing five or six feet during the season. The following spring the buds again start out near the top of the tree. Some varieties throw out three, and others four or more limbs laterally from the stock, according to the peculiar habits of variety. As each and every tree has a peculiar form of growth, as much so as the human form or features, an experienced nurseryman will not mistake a variety once in a hundred times, and he judges only by its distinct characteristics of growth. As a general rule the root of a tree conforms to the top. A straight upright top sends its main roots deep into the soil, and if the top is spreading, the roots extend nearer the surface. Now what produces the uniformity in a variety? The seedling stock has no uniformity in its growth, and consequently the bud must have changed the roots of the seedling to its own form of growth. This shows that the stock and root are subordinate to the bud. This control over the stock could not be exercised, if the grafting were done in the top of a large tree, as the stock would then have the balance of power, although I have no doubt the roots of the graft extend quite a distance down the sap-wood.

Most trees and plants hold in reserve an innumerable number of latent buds for the repair of any injury that may befall the

tree. Should a limb get broken, one or more of these latent buds would be forced into growth to supply its place. If a root gets broken the leaves repair the damage by sending out new roots to supply the top with its wonted food. Should the top lose its vigor from any cause so that it could not receive the juices sent up to its manufactory, the roots stimulate the latent buds along the trunk and limbs into growth, and numerous suckers, as they are called, make their appearance to assist the top in doing its work.

A further illustration of the power of the bud to individualize itself, is seen in the layering of grape, when the eye or bud throws down roots and becomes entirely independent of the mother plant. Many plants are propagated in this way, as also by cuttings and other methods.

The beginning of the individual plant is in the seed. It is then a plant in miniature. The seed is now independent of the mother plant, and we will now watch its course of development. We will cover it with soil, and subject it to the combined influence of moisture, heat and air, so that it may bring its vital forces into action, and germinate.

In every seed there is a little store of food for infant growth. Moisture is necessary to dissolve and transform these little stores of starch, sugar and other substances in the seed, into suitable food for the young plant. On this it will feed until it throws down its little rootlets into the soil, and its leaf-stalk up into the light and air, and then these two parts work in unison. When the plant has thus developed itself into roots and branches, the food in the seed will have been exhausted and the plant must depend wholly on the root and leaf for its support. It is curious to observe the ingredients that are so carefully stored away in the seed for the infant germ—starch and sugar—or substances convertible into sugar, which are nearly the same as are furnished by the human mother for her tender infant.

It is also said that the seed, in germinating, generates heat within itself. The degree of heat necessary for germination varies with different species, but generally a temperature of about fifty degrees is required. Blackston says: "The whole progress of plants, from the seed to the root, and from thence again to the seed; the method of animal nutrition, digestion, secretion, and all other branches of vital economy, are not left

to chance or the will of the creature itself, but are performed in a wondrous involuntary manner, and guided by unerring rules laid down by the great Creator."

My friends, I have brought forward these examples, showing the process of development of the bud and seed, not assuming that you are ignorant of these facts, but to show that we are often unmindful of the most ordinary workings of nature in the world around us; and it is because these methods of nature are so common and unobtrusive that they escape our notice. And here I would appeal to the young men and boys who are just entering upon the stage of active life, and assure them that farming can be made the most interesting and instructive employment they can pursue; that if they once become interested in the study of nature, through the medium of agriculture, they will thereby form a habit of thinking and observation, so that with every crop they raise from the ground, there will be raised in the mind a corresponding crop of new ideas. So will the problem,—What shall we do to keep our boys on the farm? be readily solved. Some few weeks ago, it was my rare fortune to witness a most beautiful phenomenon of nature. I stood on one of the bold cliffs of Mt. Mansfield, the loftiest peak of the Green Mountains, facing the eastern valley which lies between Mt. Mansfield and Mt. Sterling. The thickly wooded valley lay beneath me like a broad, green carpet. The day was declining, and the sun shining at my back. As the thin curtains of mist that hung about the mountains silently parted and revealed the wide landscape, there suddenly appeared to my sight, as if by magic, a beautiful rainbow painted upon the green carpet of the valley, thousands of feet below me. It was small in size with upright sides, and arched at the top. But the most surprising feature of this marvellous phenomenon was, that while gazing at it with wonder and delight, I beheld in the centre and at the base of the picture, the perfect image of a human form, including the body above the waist; and that image was the semblance of my own broad shoulders and head. Even the fingers of my hand could be distinctly seen. Doubting, I raised my arm horizontally; the shadow did the same. I described a circle over my head, and the shadowy hand described the circle of the rainbow. The guide, standing by my side, also had his rainbow and shadow; but neither could see the shadow of the other,

thus proving the fact that no two persons looking at a rainbow at the same time, see exactly the same rainbow.

I have described this simply as an example of those many wonders of nature, which are found in places remote and difficult of access, and which we seek with great toil and expense. But we need not climb the mountain peaks to find the wonders of creation; there are mysteries and wonders in the vegetable creation of equal interest, which every one may study and admire in his own garden free of cost. The objects within our own reach often surpass in wander those we travel miles after. These hidden mysteries of the plant are the true miracles.

A person once complained to a friend of mine, of the modern scepticism as to miracles, and the ingenious doubts and speculations of science in regard to them. My friend plucked a clover blossom at his feet, and replied—" I need no higher miracle than that. Tell us how, century after century, this humble flower has perpetuated its mysterious birth and growth. Tell us why the seed has kept its plighted faith to the spring, and year after year has blossomed always the same. Tell us who taught it to seek out in the dark ground, or in the invisible air that subtle food which it turns into its own substance. Tell us how this plant, which we call lifeless and inanimate, can produce from its own being that mysterious seed which man's inventive brain not only cannot imitate, but cannot even understand its laws, its structure or its creation; and we will then talk of other miracles, and discuss probabilities; until then we will not ask for higher miracles."

From the preceding observations, we may conclude that the leaves are absolutely necessary to cherish the blossom-buds formed at the foot-stalk, aided by the agency of light, which is absolutely necessary to the operation of the generating power, and that the blossoms and fruit are dependent on the leaves for the preparation of the food, which is derived from the atmosphere and the roots. The greater the surface of leaves and branches exposed to the influence of the sun and air, the greater the quantity of sap prepared and appropriated towards the growth of the plant; and the richer the quality of food furnished, the more robust the plant; and the quality of the fruit will be in proportion to the health and exposure of the stalks and leaves. The soil is the laboratory in which the food of the plant

is prepared, and no manure can be taken up by the roots unless first reduced to a soluble state through the agency of water, which is the great solvent in the vegetable kingdom. Plants possess the power of decomposing water, and retaining its fertilizing properties; they also possess the power of selecting and dissolving substances in the soil, and assimilating them for food.

M. P. Wilder says: "Every blade of grass, every leaf that flutters in the breeze, and every germ, is an organized and living body. Every plant and vegetable is as capable as the human system of imbibing and digesting its appropriate food. Everything endowed with vegetable life requires its own peculiar food to sustain its vigor and promote its growth, whether derived from earth, air or water."

The circulation of the vital fluids of the growing plant has been shown in our reasoning, and is being discussed by some of our learned chemists. Prof. Johnson has lately published a work of much merit on "How Crops Grow," in which he discusses this subject at great length. Much good must result from his reasoning, as it will serve to stimulate inquiry upon this very interesting subject. The theory of the circulation of the blood, by Harvey, was received with many doubts at first, and so will this theory be attended with some difficulties; it is the fate of all truths and discoveries which are new. But I feel assured that Harvey's principle will be found running through all nature, as she acts by general laws, which are universal and invariable. The perfect pulverization of the soil lies at the foundation of all true success, either in horticulture or agriculture. It has been fully demonstrated that the more perfectly divided or pulverized the soil becomes, the more readily will be dissolved its elements of vegetable growth, and disseminated throughout the organism of the plant. It is with reference to these facts that the importance of draining is seen, by which the surplus water is not only taken away, but there is also given the plant the benefit of the sun and air, which are as important to the healthy development of the plant as they are to the health and happiness of man. The vegetable differs from the animal in this, that while the animal can move about and select its food, the vegetable is stationary; and if the soil in which it is planted is not in possession of the elements necessary for its growth, they must be supplied by artificial means, or the

plant will fail to accomplish the object for which it was intended. And herein is the secret of success in cultivation. It is the great problem of agriculture to ascertain and regulate the adaptation of soil to plants, to find out the proper elements for their development, and the most economical method of supplying them. This problem is best answered by thorough study and knowledge of manures, and the right application of them. The rule to be followed is to give back to the soil, in the shape of manure, what it has lost in the crop. This has aptly been called the "golden rule of agriculture." It is only by this means that the fertility of the soil can be maintained; and by disregarding this rule, the vocation of the farmer is one of loss instead of gain. You cannot impose with impunity upon the soil any more than you can on your own physical system; both are governed by similar laws. Science as well as reason enjoins upon the agriculturist the duty of preserving the vitality of the soil, and any violation of this principle inflicts an injury not only on ourselves but upon posterity. It has been well said that "to destroy the productiveness of the soil, to squander the elements of that productiveness, is to destroy the hopes of civilized humanity. It robs posterity of its birthright to a career of progress."

The importance of the science of horticulture, we fear, is not duly appreciated. It has an influence far more important than the mere gratification of the senses. Its tendency is to elevate the character and fix the habits of a people. We, as a people, are noted for our restlessness, and this, too, while we are enjoying everything in abundance to make us happy and contented. Energy is commendable, but not at the expense of our social relations. The practice of horticulture tends to develop our social relations and to increase our love of home; and just in proportion to the intelligence and settled habits of a people, may be measured the interest manifested in horticulture and its kindred pursuits. There is a pleasure in horticulture, in the innocent pursuits of country life, just in proportion as intelligence and refinement preside over its labors. "Flowers," said Henry Ward Beecher, "are the sweetest things that God ever made, and forgot to put a soul into." The love of flowers is inherent in man. It is the seed of which love is the fruit, an

element of true religion. Flowers have been aptly called the smiles of God.

Show me the man that does not love flowers and children, and you will find him but little above the brute, destitute of the more ennobling qualities of manhood. Such a man should not be trusted. Why was it that God planted the first garden and filled it with fruits and flowers, and "every thing that was pleasant to the sight," and then took the man he had made and put him into the garden to dress and keep it, if it were not to bring him into daily contact with nature, and to give him pure, simple and rational pleasures, and to teach him happiness? Why was it that a garden was selected as the last resting place for Him whose pure life of love has lasted through more than eighteen centuries, and will continue to the end of time? Why is it that this feeling of reverence and yearning for the "lost garden" has come down to us through all the dark ages of the world, growing more intense as the world becomes more civilized and refined? Why is it that a flower will attract the notice of the infant in its mother's arms, sooner than any toy? Why is it that the older we grow the greater is our love of flowers? Why is it that we decorate the graves of our loved ones, and the graves of our dead solders, with flowers? Why is it that the love of flowers is not confined to any class, race, or nation? It is because they speak a universal language—the language of the heart—and respond to the noblest and most generous emotions of the soul—soothing, cheering, delighting, animating, subduing and refining the mind of man by their divine ministrations. Truly, flowers are God's telegraph from the soul of man to Himself—divine messengers, full of life and love and beauty.

THE RELATIONS OF SOIL CULTURE TO SOUL CULTURE.

From an Address delivered before the Berkshire Agricultural Society.

BY REV. WASHINGTON GLADDEN.

All of us are pleased to note the magnitude and the excellence of the potatoes and the pigs and the pears that these farms turn out, but the chief question is, after all, what sort of men and women are they raising? I shall ask your attention therefore, for a while, to "*Man as an Agricultural Product; or the Relations of Soil Culture to Soul Culture.*"

There is no honest calling in which a man may not preserve his integrity, and develop his manhood; and perhaps there is not so much difference as we are sometimes led to think, among those callings which are honest, in their influence upon character. There are some trades and some professions which we all agree in considering legitimate, and which we are yet wont to consider as rather hostile to the highest growth of manhood; and there are others which seem to us quite favorable to intellectual and moral development. But each calling has its advantages and its disadvantages as a school of character; and some of those which seem to us to foster the better nature do, nevertheless, in various ways, impede its growth. The work of the farmer and the farmer's wife is in some respects favorable, and in other respects, unfavorable to the development of true manhood and womanhood. The man who wants to make the most not only of his farm but also of himself, will find in the farm-life, some helps to rejoice in, and some hindrances to overcome; some incitements to follow, and some temptations to resist. Shall we not find it profitable to consider some of these, that the highest problems of life may be clearly stated, and the methods of their solution fairly understood?

First among the conditions of the farmer's life which are favorable to the best growth of the man, is the fact that the work itself is more conducive to bodily health than almost any other occupation. "A sound body" is indispensable to the highest manliness. Some men contrive, with weak and ailing bodies, to live creditable lives, but their physical infirmities are no help to their spiritual growth. Bodily vigor is to be desirable, not only because it helps us to live better lives, but because it is in itself beautiful and valuable. And the life of the farmer is more likely than almost any other manner of life to preserve and confirm the health of those who engage in it. It is true that by overwork and exposure, and unwholesome diet farmers do sometimes impair their physical strength; but the general health of the farming community is better than that of the mechanical and professional classes. And this gives the farmer a great advantage in the pursuit of manhood over his fellow-workmen in other callings. It is much easier for one whose digestive organs are sound, whose circulation is perfect, and whose nerves are steady, to be a good and true man or woman, than it is for one who is dyspeptic, thin-blooded and nervous.

Another condition favorable to the development of high character on the farm is the quiet and repose which it secures. "In quietness and in confidence shall be your strength," was the motto of the great Luther; and there is a strength of purpose and a depth of conviction which rarely come to those whose lives are spent in the bustle of town life. Indeed, the great want of our American character is repose. We are an active, hurrying, restless race; we are quick to seize a truth, or to throw ourselves into an undertaking; and we often suffer from the lack of deliberation. Our work is marred, our thinking is spoiled, our dignity is damaged by this undue haste. We are getting more and more every year to be a feverish, eager, giddy people; nervous diseases are becoming fatally prevalent; body as well as mind is giving way under this high pressure of our American life. This bad tendency of our civilization is fostered and strengthened by town life, but the farm-life gives an opportunity of resisting it. There are hurrying times of year on the farm, and seasons when the farmer must have all his wits about him, and work with all his might; but after all this strain does not often come; and it is quite a different sort of hurry while it

lasts, from the mad, noisy, exciting strifes of the town. Living apart from all this clatter and confusion, having to do, not with men who are always in a hurry, but with Nature who is never in a hurry, there is a chance for the farmer to cultivate steadiness and repose of character, graces that adorn whoever wears them.

Not only this, but the farmer has leisure and opportunities for intellectual cultivation, if he is only minded to improve them, which are denied to many other workers. It is true that the thrifty farmer is apt to find an odd job for the rainy day; a sled to mend, or a gate to build, or a fodder rack to fix for the winter; but there are many rainy days and some pleasant ones, especially in these latter days of horse rakes and mowing machines, when not much is done; and when the farmer, if he were studiously inclined, could lay in large stores of useful knowledge. Then there are the long winter evenings, after the cattle are housed, and the chores are all done, which ought to be sacred to reading and study. Unlike the merchant or the professional man in the village, who must be in the store or the office until nine o'clock; unlike the mechanic or the operative who has been in-doors all day and really needs a little walk after supper to the grocery or the post-office,—and who is apt to sit down in some lounging place and spend all his evening—the farmer has no duty to occupy his evening, and no temptation to draw him away from home; and here are two or three golden hours of every winter's day that may be turned to excellent account.

But some one is asking, What advantage is there, after all, in this reading and study? It will not make my crops grow any better or my cows give any more milk. What is the use of it all? To this I answer, in the first place, that it will be likely to be of advantage to you as farmers. Even if you read nothing about agriculture, your increased knowledge will broaden and strengthen your mind, and improve your judgment. Farming calls for mind as well as muscle, and if reading and intellectual pursuits bring strength and enlargement to the mind, then of course they help to make a man a better farmer.

But that, after all, is not what we are talking about. Even if it could be proved that the cultivation of the mind would not enable you to be any more successful in your calling, it would

still be well worth while to attend to it. For the man is of more consequence than the farmer, and the first concern of every farmer, as well as of every lawyer and every doctor, and every preacher should be to cultivate his own manhood ; to raise large crops and make money out of them if possible, but at any rate to be a man, in the highest and noblest meaning of that word. And I suppose that while you want to learn how to do farm work well, and to obtain the best results of your labor, you want to know something more than that. The chief end of man is not to be a ploughing machine, or a mowing machine, or a threshing machine. The chief end of woman is not to be a milking machine, or a churning machine, or a sewing machine. The farmer and the farmer's wife ought to be proud of their vocation, ought to magnify and honor it in their lives ; but *while* loving it, and working at it diligently, they ought to determine that they will not be swallowed up in it, but that they will, by God's grace, be all that he meant them to be in body, soul and spirit ; and if that is their high ambition they will feel that some time may be worthily given to the cultivation of their minds and their hearts as well as of their fruitful acres. And what I say is that the farmer may, easily, without neglecting anything that needs to be done, so arrange his work that he shall get abundant leisure for this class of pursuits ; that, indeed, the opportunities afforded him for these pursuits are rather better than those enjoyed by industrious workers in almost any other calling.

Another circumstance of the farmer's life which is favorable to the cultivation of manhood is in the fact that he is called to deal mainly with realities of nature, instead of the deceits and shams which abound in town life. Truth and reality are always good for the soul ; pretense and affectation are hurtful not only to him who practices, but also in many cases to him who witnesses them. And our town and city life is largely made up of pretence and affectation. Whether they are disquieted by it or not, the passengers on the pavements walk always in a vain show. Our architecture is dishonest ; almost every house pretends to be something that is not. Not long ago I got a rear view of what passes for a three-story building on one of the business streets in my own village, and found out that the building had but two stories ; the front was built one story above the roof. And that is only a sample of the way in which wood and brick

and stone are made to deceive our sight every day. There are very few honest buildings. The churches ought to be true, but many of them are gigantic lies. With mastic and stucco, and paint and sand, they contrive to look, or at any rate try to look, much more costly than they are. If the religion of the worshippers should turn out to be hypocrisy it would not be strange.

And not only in architecture, in furniture, in raiment, in equipage, in the whole outer life of the town, we are met on every side with all manner of deceit; veneering, gilding, painting, padding, stuffing—all with the design to make the exterior showy at the expense of reality. And what is true of their belongings gets to be true of men and women; many of them will hardly bear inspection. Strip them of the falsehoods in which they disguise themselves, and many of them would make but a sorry figure. Now, with all the advantages of town life, —and town life has its advantages,—this is the one stupendous disadvantage to the cultivation of true manhood or womanhood. To be obliged to live in the midst of so much that is fictitious and false; to talk and deal every day with people whose manners are affected and artificial, is a hard strain upon the sincerity of any human soul. Before we know it, we have the mask on ourselves, and go about parading our deceptions before the eyes of our fellows. This vice of pretence, more than almost any other, justifies Pope's often quoted verse. It looks ugly enough at first sight:—

> "But seen too oft, familiar with her face,
> We first endure, then pity, then embrace."

This, I say, is a crying evil of town life, and it is an evil that is assailing the very foundations of good society. There are true and honest men and women in the cities and the villages, but it is hard for them to maintain the virtues of simplicity and sincerity in the midst of the deceit that abounds. And you, my friends, the farmers, are but little exposed to this evil. Honest old Nature—who does nothing for show, who never pretends to be more than she is, who never puts on fine colors that she cannot afford, who never smirks at you, or patronizes you, or tells you white lies—honest old Nature is your daily companion; and if she does not make you truthful and sincere, it is your fault and not hers. And I am bound to say that affec-

tation is not the besetting sin of farmers generally. They have faults enough of their own, but this is not chief among them. They are sometimes crabbed, and sometimes miserly, and sometimes conceited, and sometimes uncharitable ; but you can generally find out what they are ; that which is worst in them lies on the outside, and there is no effort at concealment. There is a little danger that their contact with the town's folk will damage this good quality of their characters. Even now we sometimes see the country maidens, and the country matrons, too, trying very hard to imitate the city manners and the city fashions ; and so far as this helps to introduce a little taste and elegance into the farmhouses, it is well ; only let them beware how they bring into their rural homes the shams and falsehoods that disfigure the urban life. Let them love and study and copy the traits of the country, that God made, rather than of the city, that man made, and keep for us the beautiful simplicity of life and character that is growing so conspicuously rare.

The last thing I shall mention that helps the farmer to be a man, is the consciousness that ought to possess his soul that the work about which he is employed is productive, and therefore beneficent work. I am speaking on the supposition that he is a good farmer, and not only raises good crops, but improves the condition and increases the value of his land with every year's cultivation. For the man who is spoiling good land by bad tillage is one of the worst of malefactors, and his work can have no tendency to make him a better man. But one who is doing his best to reclaim waste land and make the good land more fruitful, who is gathering every year larger crops of better produce with less labor, he is engaged in a work which is really enriching the earth ; he is providing for the sustenance and adding to the comfort of the earth's inhabitants ; he is diminishing the dangers of famine and pestilence ; he is a real benefactor of the race ; and the knowledge that this is the nature of his calling ought to make a farmer proud and happy—ought to inspire him with that just self-respect which is one true constituent of the highest manliness. In the nature of the case, we cannot all be producers ; our complex civilization calls for other kinds of work ; traders and artisans and professional men are wanted ; but after all, the producing classes are doing the best kind of work. And as a man's calling is apt to react on his character,

it would seem that the farmer ought to be the best kind of man. The business of trade has become the favorite business in these days; the farms are deserted by the farmers' boys, and sometimes by their fathers, who are rushing to the cities to engage in commercial pursuits; but trade is far less beneficent and far less honorable than farming. We might contrive to dispense with the trader, but we could hardly live without the farmer. He who makes two blades of grass grow where one grew before, is a public benefactor, we are told; but he that sells two yards of tape where one was sold before, may be a public nuisance. It requires no gift of prophecy to foresee that the current which is now sweeping our young men into the whirlpools of traffic, will be turned back ere long towards the farms. The risks and failures of commercial life are increasing every year, and there is no remedy for them but the withdrawal from these crowded pursuits of a part of the surplus of competitors; and by and by we shall see the deserted farms reoccupied by men who have been wearied and disgusted with traffic, and who have learned to believe that the business of a farmer is not only in the long run more profitable, but more dignified and more conducive to true manliness than the uncertain and questionable strifes of commercial life.

In the healthfulness of his work, in the quietness of his life, in the ample opportunities of self-cultivation afforded him, in the fact that he is called to deal with the realities of nature rather than the shams that infest the town, and in the consciousness that he is helping to make the world a better home for the race, the farmer finds conditions favorable to the development of his manhood. But there are also in his calling, as in every other legitimate calling, hindrances as well as helps to manliness, and I am to speak briefly of some of these.

Some of those conditions that were mentioned as favorable to the growth of character, may, if they are not guarded, become unfavorable conditions. The quiet of the farmer's life may secure repose and steadiness of character; but if the quiet is too profound and without interruption, it may result in stagnation of the brain. A certain amount of excitement and stimulation is needed to keep us awake, and the farm life may be so ordered that there shall not be enough of it.

Moreover, the farmer's work, if he keeps at it too persistently,

and denies himself needful rest and relaxation, is hurtful not only to his body but to his mind. Manual toil pursued without intermission from early morn till late at night every day in the year, is benumbing in its effect upon the mental powers. Some degree of physical exercise is necessary to the healthy action of the mind; but such hard work as some of our farmers do, is far from being conducive to mental activity. The introduction of machinery is a great advantage to the farmer in this respect; it makes his burden of toil much lighter, and renders it possible for him to perform all his work without experiencing the deadening and stupefying effects which are so apt to follow severe and protracted bodily exertion. Still the farmer has need to guard against mental sluggishness and torpor; and that is one reason why he should cultivate a love of reading. The stimulus which he gets from newspapers and books will keep him mentally awake, even if he goes out but seldom. He ought not, however, to shut himself up at home, even in the good society of good books. His business will carry him occasionally to the neighboring village or city, and his contact with the intense life of the close populations will quicken his pulses and do him good. In the winter there will be a course of lectures perhaps within reach; and if he buys a season ticket, and takes the trouble to attend with his family, he will hear some utterances that are wise and some that are otherwise; but on the whole, because of the stimulus thus given to his mind, the lecture ticket will be a good investment. And if I were not a minister, I should say that the habit of church-going would be of considerable advantage to him, not only spiritually, but also intellectually. Besides, it seems to me that it would be good for every farmer who can spare the time and the money—(and most of you can if you think so)—to take a short journey every autumn after the crops are gathered, into some region which he has never visited before, keeping his eyes and ears open, and learning what he can, not only about the best methods of agriculture, but about men and things in general. In such ways as these the depressing and stupefying effects of seclusion and muscular toil may be averted, and the mental wakefulness and vigor which are essential to the highest development of mankind may be secured.

The slow gains of the farmer are sometimes a stumbling block in his way. With unremitting industry, with the greatest fru-

gality in his manner of life, his profits on the year's work are small, when compared with the great incomes of some of our successful merchants. When we think, however, that about ninety-eight out of every hundred of our merchants are unsuccessful, and reflect how large the balances are on the *wrong* side of *their* cash books every year, the farmer's small but tolerably sure accumulations look very respectable. His accumulations are, at least in the beginning, quite small. He *must* count his pennies carefully, or there would be nothing left. And so he naturally enough comes to count his pennies rather too carefully; falls into penurious and miserly ways. I do not know that this vice of parsimony is any more frequent among farmers than among other people; but it is a vice into which all people are liable to fall whose gains are slow and difficult. Yet the most generous men I have ever known have been farmers, and the best illustration I ever heard of the profitableness of generosity, was given me by a farmer. The story was this: Two brothers, one of whom was penurious and poor and the other generous and rich, met one day in the barn of one of them, when the poor man said to the other, "How is it that you being free and bountiful in your gifts, are growing rich so fast—while I, who give away very little, am always poor?" "I will show you why," replied the other. They were standing by a barrel of flax-seed, and the prosperous brother thrust his hand into the seed and grasped in his closed hand as much as he could of the smooth and shining kernels. On opening his hand hardly any remained; the seed had slipped through his fingers. "That is your way," he said, "but *this* is my way;" and in his open hand he scooped up a liberal handful of the seed. Remember that, good friends! *The hand that is open to give will hold more than the hand that is clenched to keep.*

There is another and more serious vice into which these slow gains may lead the farmer. That is the vice of dishonesty. He is obliged to work so hard, and his profits are so small, that when he comes to sell his grain, and there are ninety-seven or ninety-eight bushels of oats to dispose of, he is greatly tempted to strike the measure quick enough to make the pile hold out an even hundred bushels. He is just as much tempted to do that as the small trader is to slip his thumb a little in measuring the calico; and he is just about as likely to yield to the temptation. I heard

a farmer talking on this subject the other day. He was a man who had been a broker in one of our western cities, and had had large experience with the commercial as well as the agricultural classes; and his opinion was that the average of honesty in the commercial class is higher than among the farmers—that there is an amount of small swindling and trickery among the latter that would not be tolerated among the former. But that statement I could not bring myself to accept without some qualification. I know that it gets to be accepted doctrine among these financiers that a big swindle is perfectly legitimate—that it is only the little ones that are vicious; that the man who steals a railroad ticket is a villain, but the man who steals the railroad itself is a highly respectable man. This is a kind of logic that that is too high for me. I could never make it appear that the guilt of theft is in inverse ratio to the amount stolen, or that the big-bellied admiral who steals the ship and sails it, is not at least as big a rascal as the scullion who steals the admiral's spoons. But still there is guilt and meanness in cheating on a small scale; and I know enough about farmers to be ready to admit that the criticism is not wholly without foundation. I do not think that farmers are more dishonest than other people—quite the contrary I should say; but I have the best of reasons for knowing that there are dishonest ones. I have bought some barrels of apples that were just as large in the middle as on the top—but I have bought other barrels in which the apples grew small by degrees and beautifully less as you went down. I have paid for some cords of wood that wére eight feet long, four feet wide and four feet high; and I have paid for other cords, trusting to the measurement of the man who brought them, which have shrunk wonderfully when piled up in my wood-shed. To such small dishonesties as these the exigencies of the farmer's life quite naturally lead, and they, above all things, are to be shunned and abhorred. Nothing is more fatal to true manliness than trickery or fraud of any sort. No man who values the essentials of life more fully than its accidents, or who has any just idea of what true value is, will descend for a moment to any such transaction. You can afford to work hard and live frugally and get on slowly, but you can never afford to stain your hands or pollute your soul with the least deed of dishonesty.

AGRICULTURAL FAIRS AND THEIR PURPOSES.

From an Address before the Hoosac Valley Agricultural Society.

BY PROF. JOHN BASCOM.

Few branches of industry have shown more growth and prosperity during the past forty years than farming. This fact is due to various causes. Men of science have directed more than usual attention to agricultural inquiries; and questions of tillage, manures, the propagation of plants and trees and the breeding of stock, have had much light cast upon them. Invention, also, has been remarkably called forth in connection with agricultural implements, and the gathering in of the harvest has been converted into a triumphal procession. The farmer steps from his mower to his tedder, from his tedder to his horse-rake, from his horse-rake to his wagon, and rolls on wheels from the first clip of the knives to the last forkful at the mow. Time used to be presented as marching down the years armed with a scythe; if we would now intimate his ability to do a fast job, and shear even the generations of men, he must be mounted on a Wood's mower and reaper.

Another means to this progress has been the agricultural fair, and it is this which we wish to make the subject of our address. Our remarks will take two directions—the purposes which these fairs subserve, and the best methods of supporting them. An obvious advantage of them is, that they draw general attention to the products and processes of agriculture. Farmers carry on their labors in comparative privacy. No one oversees them; few are interested in the exact way in which they do their work. A bushel of corn or potatoes brings the same price, no matter who raises them, or how small the crop. The mechanics and merchants of our cities and villages are brought into constant comparison with each other, and their daily employment depends

on the success with which they meet it. It is impossible to tell how poor a farmer a man may be, and still find something to do, and a little to live upon.

What, therefore, farmers need are eyes, many eyes, intelligent eyes, eyes out of which are looking thoughtful and experienced men, to be directed toward them in continual scrutiny and criticism. The best farmers are usually on the most travelled roads, and in part because more persons see them. If every time that a man ploughed his field or hoed his corn, one whose judgment he thoroughly respected were looking at him over the fence, much work would be improved without our scarcely knowing why. I am never more aware of the defects of what I do than when I review it with one whom I know understands thoroughly how it should be done. I walk through my orchard with an horticulturist, and feel more painfully than ever before every neglect of which I have been guilty; and this, not because he points them all out, but because, being with him, I look sharply over my practice, as I suspect him to be doing.

Many men are tough, and farmers not the least so; they should therefore be often pricked with criticism, made uneasy in their faults by close observation, looked over in their doings in a straightforward, common-sense way; and as they have no one to do this work for them, they cannot do better than to get together and do it for each other. Every good method is thus made contagious, every sound principle catching, and tasteful and thorough farming becomes an epidemic. It is not good for men to be alone; above all, one that is a little dull. The wise heads are put in the world as leaven, and the large assemblages of the agricultural fairs give their ideas an opportunity to ferment and propagate. It is good to touch the hem of a man's garment that knows more than we do, and one is likely to find them on these occasions set apart to ideas.

This leads us to the second advantage of the fair. Farmers do not simply look at each other, and their respective cattle and produce; there is provision made for their definite instruction in various ways. The best tools and machinery of the farm are exhibited, and, so far as practicable, operated. One is able to decide on the merits of an instrument before the purchase, and is stimulated to the right purchase by the opinions of those on whose experience and judgment he can rely. The best qualified

men of the community are present on purpose as committees to examine and pronounce upon stock, crops, fruits, produce of all sorts. The opportunity for comparison is present to every one, and his conclusions are corrected and guided by the carefully formed opinions of those about him best fitted to decide the point. In this contact and clash of opinion, there cannot fail to be instruction. To these sources of information is added the annual address, which is, or at least ought to be, another source of ideas. On the whole he is a very smart man or a very stupid one who has been in faithful attendance on a agricultural fair, and has gained nothing worth his labor. The first should console himself with the fact that he may have given something to others, and the last with the thought that he would not probably have profited much anywhere.

To these influences of the fair are to be added prizes, which, if well offered and justly bestowed, serve to direct attention to the right points, to push improvement in the most important directions, and to call forth a little pleasant rivalry among the bright and progressive ones. To do anything better than his neighbors, makes a man think well of himself, and inclines him to try again. Steady improvement in some branch of farming is often to be dated from a prize taken years ago, and followed by a goodly succession in the same direction. The premium gives a direct motive and a definite end, which we often want, and for the lack of which suffer opportunities to slip from us close at hand. They get one agoing, and with a yearly joy, keep him agoing in the line of improvement.

A last advantage of the fair to be mentioned is, it magnifies the farming community, puts enthusiasm into it collectively and individually. It is good to have a grand rush of one's industrial kin once a year, to feel that your name is legion, and that there are a variety of things possible to you. To be choked with dust, crowded and discommoded generally by one's kindred in labor, is profitable in the elevation it brings, the sense of importance and power. No man is worth much in a calling who has no enthusiasm in regard to it. That farmer is the best farmer who believes, with profound conviction, that a big calf or a big pumpkin, is a *big thing* ; and how can he, unless he is to open the eyes of a thousand people with it, and carry it in the back of his wagon for the envy of a hundred more? It may seem

trifling to kindle enthusiasm by mutual admiration and congratulation, but few things pay better in the long run, if only our praise be honest and well earned.

We pass now to the methods of maintaining the agricultural fair whose value we have vindicated. A first condition of success is intelligent, enthusiastic, self-denying officers. Some farming communities come under the condemnation, " from him that hath not shall be taken away that which he hath." There is not sufficient percussion and tinder in them to build a fire with ; there are not those who have the energy, the knowledge, and the good will requisite to organize and maintain a vigorous society. The first recipe, therefore, for success in the fair is, have some good, disinterested men among you ; and if you have not such, pray for them and try to make them. There is no seed more prolific than generous, liberal thought, ready for work and sagacious in it. Let us congratulate ourselves that we have men, like our late president, who had gathered the knowledge of long experience with a diligent and liberal hand, and who not only sits under his own vine, but has given many of the rest of us vines to sit under, and fruit to feast on there.

A second necessity in the management of a fair is, that the end of instruction and justice should be kept continually before its committees, and they should never be content with simply striving to please the largest numbers, to divide the spoils satisfactorily. Let there be justice though the heavens fall, is a good proverb. I have observed, however, that the heavens seem to stand remarkably firm after every stroke of right doing. It would signally strengthen this integrity and good judgment of our committees, if they were required to give, in a few lines, the reason on which all important awards were based. One cannot give a reason till he has one—nor is he quite inclined to give it, till he thinks that he has a good one. These reasons appearing in the annual report, would be freely canvassed, and all would be instructed, both as to what is regarded as best, and why it is so regarded. Our reports would thus be made manuals of farmers principles and precepts. The class of persons who are alienated by unsound and unjust awards, are those a society can least afford to lose, on their own account and on account of their influence over others. It should then, be the first aim of a society to justify its premiums to the best judgment of the

community, and to impartially, fearlessly, and constantly declare that to be good which it thinks to be good. We think our lady friends would sometimes suffer under this rule, and would hardly be taught by prizes on bed quilts to cut up good calico that it may be sewed together again in odd, fantastic and absurd shapes. We have never devised but one theory on which these preposterous, patch rose-buds could be justified,—possibly an old woman might do worse.

A third fatal mistake in the management of an agricultural fair is to suppose that its primary end is to pay expenses and make money. If it does this, very well; and it will be all the more likely to do it, in the long run, by not making it the constant aim. It is a fault with us, in all pursuits, that we strive to make money *out* of our business, rather than to establish a valuable branch of industry for the benefit of others and ourselves. If we could be brought to deal more liberally with our avocations, expect less of them at once, do more for them, furnishing the means and the time for growth, we should find our returns in the end larger and more reliable. We rather, in our haste and ignorance, wish to place our pail under the first branch of labor we lay hold of,—as yet an unthrifty, half-grown heifer,—and milk it full at once, leaving the ill-used beast afterward to care for herself. This spirit and method are not safe and wholesome in any direction, and especially are they not so in any enterprise which pertains to instruction and progress. A church, a college, a fair, cannot be well handled with the leading idea of meeting expenses. There must be a more thorough appreciation of the ends of improvement and a more generous devotion to them than this implies. An institution which is valuable is likely to be profitable, and no other is likely to be for any length of time. Money that is drawn *out* of a business leaves it pretty lean, and not prepared to yield much more. A good fair invites coöperation, and pledges every strong man to its support.

The direction in which this desire for an immediate income has wrought especial mischief is that of horse-racing. We say nothing of its moral character one way or the other; we simply say that it has been frequently and manifestly injurious to our fairs. A race in which horses are put to their speed has nothing to do with farming; the connection is no more direct than

that between the circus-ring and agriculture. The horse, as an instrument of industry and ordinary use, must possess qualities quite the reverse of those which belong to the racer. To breed for the plough, the cart, the carriage, requires attention to one set of characteristics and form of training; to breed and make ready for the course calls for attention to a very different set. In the degree in which a horse is fitted for the turf is he usually unfitted for every other service. It is because horse-racing is a popular amusement that it so easily engrafts itself on to the fair, and becomes, by attracting the masses, a means of enlarging the income. Now we are not so crabbed that we object to this simply because it gives pleasure; so far we grant the argument is with those who sustain it. But let us look a little at the later and less obvious results. The horse-race, once in, easily lifts itself into popular favor; begins to do the work that was expected of it, and "draws." As the horse-race is doing so much for the fair, more, it is thought, must be done for the horse-race. An entire day is set apart to it. It is soon difficult to confine it in these limits, and gradually half the time and three-fourths of the attention are given to it. It now "draws finely." Premiums must be devoted to this captivating and crowning feature, and the best horse carries off his hundreds, while the best sheep and ox must content themselves with a few dollars. An entire department, as crops or fruits, will thus often receive less than is bestowed on this single form of development, entirely foreign to agriculture. Pumpkins, squashes and beets begin now to be a little dull, and boys and men are running to see whether Jones' gray or Smith's bay is ahead. The popular mind, not too full of ideas at the best, forgetful of other considerations, is fevered by this ready-made and respectable amusement. Every plough-boy begins to think himself one of those

> "Charioteers,
> Who, with burning eyes, lean forth, and drink
> With eager lips the wind of their own speed,
> As if the thing they loved fled on before."

The poor nag, stiffened by many a hard pull at the stone-boat, who needs to be brought gently home and put kindly to hay, is sent along the road at a pounding pace, as if there were some speed in her which it were a sin not to get out before she

dies. The four year old boy cannot now draw his baby brother without some one to cry, go; while, for a month after the fair, Tom, Dick and Harry sit in solemn conclave, and spit tobacco over the question, whether Brown's sorrel wouldn't have come in first if she had not lost her shoe, some one of the gentry of the lash occasionally routing their small opinions by a louder oath and a more professional air. The horse-race is now "drawing" in such shape that things are likely to come to a head. Some begin to inquire, why not all horse-race and no cattle-show, since this is what we really like? Others—the sober, intelligent farmers—bitterly disappointed in the results, are asking, why maintain a fair in which the hall is deserted for the track, and a few women and old men are all that are left at the speaker's stand? David Crockett was said to be "half horse, half alligator." I never quite believed it, for I fancied the alligator would have eaten up the horse, and he would shortly have become all alligator. Thus a fair half cattle-show and half horse-race is in a state of unstable equilibrium. The horses run away with the fruit and cattle, and it is soon all horse-race. It has happened to some fairs within our knowledge to spawn a race-course, and die in the effort; and more than one has found their progeny competing with them in hot rivalry. If an agricultural fair gives itself to amusing and intoxicating, instead of sobering and instructing the populace, it will soon find that others can outstrip it in this race, and that professionals are quite in advance in their own line of business. The jockey will stoop to the fair when he can get nothing better, but becomes at once ambitious of an independent course.

The New York State Fair has steadily prospered, because it has kept aloof from the race, and given large and profitable development to all improvements, implements, agricultural machines. Many of her county fairs, on the other hand, poor in these means of instruction, have yielded themselves up to the race, and become of little interest and value. I would like to inquire, in this connection, why the Bennington race-course came up as the Bennington fair went down? and whether the feebleness of the Hampden Society has not kept company with an increase of the horse distemper?

We do not, then, object to this intimate association of the race-course with the fair because amusement is thus furnished,

but because it is amusement of such a nature as to intoxicate the many, and draw off their attention almost wholly from the real object of the association; because it is an amusement of such a nature as to offend the more sober, and by its excessive claims to alienate them from the fairs, which must be sustained by them or fail. To place a bottle of wine and a glass of water before a man may answer, if he is a perfectly sober citizen. If he is not, the water will be very secure. To place before the undisciplined, uncontrolled populace a horse-race and a lesson in agriculture, is to give the latter the go-by; is to jilt the gentle goddess of husbandry in favor of the wild-eyed, hair-streaming deity of the turf. Man is a respectable being; but if there is one position in which he is less so than another, it is when he is the mere tail of a horse. He seems himself to be well aware of this fact, and usually sinks in his language and tastes to his new position.

Such are some of the gains and some of the dangers of the agricultural fair. It can only lead to good farming, as it springs from good farming, and is sustained by good farming. A needful and correspondingly noble labor is given to the farmer. He feeds the life of the globe, and should bring to this chief employment the enthusiasm, skill and patience of a great calling.

OPPORTUNITIES OF THE NEW ENGLAND FARMER.

From an Address before the Housatonic Agricultural Society.

BY RICHARD GOODMAN.

In August, 1810, Elkanah Watson, then an amateur farmer in Pittsfield, with twenty-six others, prepared and presented an appeal for an exhibition in the square in the village of Pittsfield, on the first of October ensuing, from nine to three o'clock, at which time the first Berkshire cattle-show was exhibited with considerable eclat, though the farmers in the vicinity held back many of their animals for fear of being laughed at, "which," says Mr. Watson, "compelled me to lead the way with several prime animals;" and as he had previously purchased some blooded pigs from Dutchess County, and Durham, or, as they were then called, English bulls, from Cherry Valley, in the State of New York, he was probably enabled to make the Pittsfield farmers rejoice that they had not put in competition their long-legged, tall, lank-sided swine, and their diminutive, peak-backed mongrel bulls. But this show prepared the way for the "real exhibition" of 1811, and the incorporation of the Berkshire Agricultural Society, with ample powers but no funds. The clergy were at first shy of officiating on these occasions, considering them bubbles of the moment; but these bubbles have increased into tidal waves, washing not only the shores of New England, but the whole American continent. The list of agricultural fairs in the United States amounts to at least one thousand, and wherever the Yankee farmer goes, he carries with him, in addition to his pulpit, his school-house and his town-meeting, his annual cattle-show; and neither ministers nor lawyers are any longer shy of officiating on these occasions, either as exhibitors, preachers or spectators.

But Elkanah's troubles were not over even after the successful establishment of the Berkshire Agricultural Society, and the filling its coffers with the aid of funds from Boston. His next endeavor was to get the female part of the community to identify itself with the society. "It was a great object," says the enthusiastic old man, when, in his old age, relating these occurrences, "to excite the females to a spirit of emulation. We were satisfied no measures would lead to that result with so much certainty as premiums on domestic manufactures, and closing the second 'farmers' holiday' in innocent festivity by an agricultural ball; also to unite them in singing pastoral odes at the church." All of which was effected in 1813, as well as the organization of a viewing committee of agriculture; and the old gentleman relates with marvellous interest how he managed to induce the weaker sex to assemble together in a private room, "where some valuable premiums of silver plate were exclusively devoted to them," to be awarded on domestic manufactures, and how they wouldn't go in until he procured his wife to precede them, *such was their timidity!* "And what a glorious sight," said he "to see a group of the most respectable farmers, as if under the solemnity of an oath, critically inspecting in the midst of fields of grain, grass, vegetables, &c.; also the state of the orchards, buildings, fences and farming utensils, and to witness the anxious candidate for premiums attentively seizing every lisp favorable to his husbandry or probable success. A sight," said he, "more exhilarating to the friends of patriotism, than to view the gorgeous pageantry of palaces and their pampered tenants decorated in gold!"

This was a little more than fifty years since, and the "Berkshire system" of cattle shows, with some modifications, has prevailed over the country. The novelty of crop viewing has vanished with the timidity of the fair sex, who are no longer afraid of being laughed at, but rather dare to do whatever man essays, and we are to-day assembled as members of one of the most flourishing of these exhibitions, at the close of a bountiful harvest, to bring together our best if not first fruits, to exhibit our best animals, our wives, our children and our noble selves, and to listen to the lesson of the day, and wind up our festivities by relieving our treasurer of his load of silver. Now, if we had time, the true way of arriving at the best results from our gather-

ing together, would be to resolve ourselves into a model town-meeting, with a president and presidentress, and give the substance of our doings during the year, and then compare notes and strike the balance in favor of those who have served the Lord as faithfully when planting, manuring and hoeing, as when singing hallelujahs, and whose handiwork bespeaks His and their praise. But for the same reason that the ancient Wittenage-motes or assemblies of the whole people have to give way to the modern contrivances of Parliaments and Legislatures, in which the few represent the many, on this occasion we are forced to put up with a substitute, or representative, whose endeavor will be to hold up your hands in the good work, and set before you some of the privileges and responsibilities, as well as opportunities of farming in New England.

"What a poor cuss the man must be who owns this farm," said a traveller, as he rode past an immensely neglected one. "Not so poor as you think," exclaimed a voice from a head which peeped out over the wall, "I only own one-half of it!" This anecdote might have been plastered on to a good many farms, even in Berkshire County, in Watson's time, but since then wherever it has paid to farm well, cultivation has advanced, and a man is not ashamed to own a whole farm in any settled part of New England, and the brains must be wanting where some use cannot be made of all the arable and woodland, and a profit realized in the multiplication of animals, the sale of butter, cheese or milk, the distribution of vegetables and small fruits in our manufacturing towns, the supplying of beef and lambs to the butchers, hay and grain to the villages, cream to the hotels, and in other ways converting not only potatoes, but all the produce of the soil into human nature, *for a consideration.* We have ceased to have a bee for the purpose of removing into the neighboring stream the manure incumbering our farm-yards, and our system of enriching the land is no longer comparable to the farmer's cider which was so weak that the drinker asked him how many barrels he made last year, and on being told fifteen, replied: "If you had had another apple you could have made another barrel!"

The old prejudices and superstitions—which, like rats in a trap, get into men's minds easily, but find a great difficulty in getting out—against "high farming," including in that phrase the best

modes of culture, draining, use of most improved implements, blooded and high grade stock, and getting information from the experience of others as related in agricultural papers and books, have been eradicated, and we are now prepared to go on developing ourselves and our farms as rapidly as possible, and we are not prepared to say that we can discern the beginning of the end when improvements in agricultural processes or results will cease.

Having arrived at this point in our progress, it is time for us to consider what we have to accomplish, not merely as farmers, but as men and philanthropists. Every man's pursuit is ennobled, not only by the character of the work he is engaged in, but by the object for which he works, and the one pursuit is as respectable as another, provided it is directed towards noble ends. The man who lives but to *continue* without any definite object in existence might as well be in one business as another ; he ennobles none and none shed lustre on him, because his purpose is not defined. *We* have a mission, and it is of the highest importance that we discern what it is, and in what manner we can best promote its interests.

As a nation we are an agricultural people, more so than any other people in the world, and we are destined, not only to feed untold multitudes on our own hemisphere, but to export food to the wanting myriads across the oceans, who even now depend upon our breadstuffs to eke out the measure which falls to them from the large producing, but continually narrowed fields of the old world. With a population now of forty millions, that will probably be expanded to a round hundred millions before the year 1900, with possessions enlarged from the original narrow strip along the Atlantic coast, into a mighty empire, stretching three thousand miles across the continent to the Pacific Ocean, and upward from the Mexican gulf to the northern lakes and the Arctic regions of Alaska, with nearly fifty thousand miles of railroad that bring all sections of the Union into quicker communion than existed between Boston and Washington when the first agricultural society in Berkshire was established, with one hundred and fifty thousand miles of telegraph enabling widely separated States and people to interchange intelligence more rapidly than could have been done thirty years ago between the towns of a single county, what vistas of national greatness burst

upon the mind when contemplating the future, and how immense the responsibility resting upon us, to shape that future aright. And step by step, with the expansion of territory and the increase of population, is the diffusion of all knowledges. Sciences are within the reach of the school-boy, no longer locked up in libraries, but disseminated through schools, colleges, periodicals and papers; literature is peddled as industriously, from house to house, as tin-ware. Art has its multiplication table, in photographs and chromos; the ballot-box turns every man into a governor, and even fools rush in and appear to do very well where *formerly angels feared* to tread.

It is only ignorance of the true principles of agricultural science, and the best modes of agricultural practice, that leads men to the adoption of a wandering manner of life, and a scarifying of the soil instead of thorough cultivation. The two systems of farming—high and low, or thorough and superficial —are like the two systems of civilization—the Asiatic and the Egyptian—which preceded the Hebrew culture. The former induced a wandering, migratory sort of life; the latter was directed to things of practical utility. The study of the seasons, the labors demanded by the cultivation of the earth, the necessity of providing against the overflowings of the Nile, the forethought and contrivance thus imposed upon men, and the early discovered convenience of an interchange of superfluous commodities, opened a career to industry, commerce and the arts, which essentially modified the Egyptian civilization, and through that surrounding nations, and eventually, through the Hebrews and the code of Moses, future ages and its influence, through our pilgrim fathers, extended to this continent.

Agriculture, the industries and commerce are the tripod on which stands the great nation overruling this western world; and if one leg of the tripod is weakened, the whole fabric is shaken and may totter to the fall. Our concern is with agriculture directly; and the mission of New England farmers is like that of the ancient priestess, to keep the sacred flames always burning before the altar, that the torches elsewhere which go out may be rekindled, and to send forth a refined and improved civilization and culture which shall restore the waste places, and not only prevent barbarism from obtaining the ascendancy, but, by scientific cultivation, cause the earth to

yield tenfold beyond her pristine efforts; and as the marts of industry narrow the quantity of land, the quality shall so increase as to more than compensate for such withdrawal. New England churches, ministers, schools, teachers, doctors and lawyers have exerted their due influence over the whole continent; and it is so far from being exhausted that the cry is still for more; and our pulpits, professional and scientific chairs are being continually emptied at the cry of give, give, send, send, from the exhaustless maw of the West. The next cry will be for scientific agriculturists who shall repair the broken ways of the hasty forerunners, and enable the populations who have stripped the surface of its richness, as their ancestors the rings from the ears and noses of the aborigines, to restore the land by the improvements in agricultural practice, which alone can enable them to compete with foreign prices, or even produce enough for the adequate support of the millions so soon to dot the whole regions on which now range the Indian, the bison, and the caravan of the emigrant.

But whilst we are ready to admit that agriculture is a fundamental source of our national prosperity; that the wearing out of land in the older and Western States is a matter of serious concern; that a remedy is needed; many are disposed to question the propriety of considering agriculture as a science that can act with precision and be moulded into shape, form and continued progress, but rather like a pile of bricks of different sorts and sizes, from which all can take and shape such fabric as each individual mind conceives, and then instead of one uniform structure we have thousands of incomplete, incongruous ones. But look further and see some master builder whose sagacity and skill are equal to the task of selection, and constructing a symmetrical edifice, and you will realize that the fault is our own, not that of the material, if the structure is not as it should be.

But you say, agriculture is uncertain in its results, depending upon the nature of the soil, the character of the climate, the atmosphere, and seasons, as well as instruments of culture, to produce its best effects, or any improved effect at all. How can it be a science adapted to man's capabilities, and upon which he can rely to restore the neglected soils and make the barren desert blossom like the rose? Agricultural science *is* empirical, experimental, and so are the acknowledged sciences of medicine,

law and divinity—all tentative, and therefore progressive and adapting themselves to the needs of every climate, soil and disposition.

Agriculture is no less a science because the means used are not always adapted to the end in view. The only wonder is that with the little knowledge we have of the mysteries of the soil and its creative agencies, we arrive at so certain results as we do, and our great aim and endeavor should be to understand more thoroughly the constituents of the land we cultivate, the means of developing its greatest capabilities for production, the true method of maintaining and restoring our lands to fertility, at the least possible expense in labor and money, the multiplication of domestic animals, (which George Washington used to say was one of the greatest blessings to be bestowed on mankind,) the improvement of our vegetable productions, as well as our breeds of animals, and the art of adapting our skill to special crops or animals most suitable and profitable for the particular locality in which we are situated.

Oh! but say some, we don't want to go West and redeem the faults of those, who, in their hasty progress have done so little for the true interests of agriculture. That's just the point, my friend; it is needless for you, or me, or any of the well settled farmers of New England to leave their homes. Enough will want to go from our own households to make it necessary rather to restrain the inclination than foster it, and our duty is to see that these that set out, have their lamps burning, their armor well on, their weapons properly adjusted that they may officer the armies of the uncultivated and do credit to our training and adaptation of their skill to their special calling. The famous seventh regiment of New York City, as a body, did nothing more illustrious in the late war, than go to Washington and Baltimore, and by garrisoning these points when danger threatened, allow other regiments to go to the field, and defeat the enemy. But over six hundred of the privates of that well organized body, took rank as officers of other newly summoned regiments, and by their skill did more good in drilling and bringing into preparation for active work these new levies, than if they had remained in the old seventh, and in that shape near the enemy. We had men enough for soldiers. What we wanted were skilful officers, and our West Points and military schools and military organiza-

tions supplied them. Now we propose by an early education in common schools, and behind the plough, continued when possible in academies and agricultural colleges, to educate, at least, leaders enough to make the advance of agriculture a certain thing, and fill up all the gaps which may be occasioned by heedlessness or disaster.

But, say some others, we know all that can be learned of the processes of agriculture already. We can raise good stock, cut and store our hay and grain successfully, manure and hoe our crops, and generally maintain our farms and ourselves profitably and comfortably. Of course, those that know everything are incapable of learning anything more. They remind me of an incident on a recent trip of one of the Illinois river packets—a light draught one, as there were only two feet of water in the channel. The passengers were suddenly startled by the cry of "man overboard." The steamer was stopped, and preparations were made to save him, when he was heard exclaiming: "Go ahead with your darned old steamboat, I'll walk behind you." Now, if there are any here so smart that our steamboat is too slow for them, we would respectfully recommend them to go ahead and let us follow more slowly, and as Pat said of the harrow, after the teeth fell out, we shall "*go a bit smoother* without them."

There is another class of objectors who are continually exclaiming that farming don't pay; that other kinds of work are more agreeable; and point to the wealthy merchant, the millionaire, banker and the railroad Crœsus, as more worthy of imitation. It would be a sufficient answer to these croakers to say, that the necessity for farmers exists, and will always exist, and that the work must be done by somebody, and must be made to pay—must become agreeable by habit. I don't suppose it is agreeable to the blacksmith, the machinist, the factory operative, the effeminate clerk, the toilers in cities, on the vasty deep, in mines, the myriads of workers above and below ground, who follow their trades from dawn to twilight, to pursue their various occupations so continuously, and get but the pittance of their day's wages, and have in too many cases no house nor permanent home, and when they die leave their families to the cold charities of the world. It certainly can't be agreeable to the hard-working ministers all over the country "to be, to do

and to suffer" for the small salaries they receive; and, in comparison with the numbers engaged, there are as many lawyers, doctors, and a great many more merchants and petty tradesmen, who receive less in the way of comfortable living, and a certainty for the future, than farmers. All these hard-working orders occasionally look up to the few comets who rush madly across our spheres with their golden tails, and wish vainly that they, too, had the talent of turning everything into precious metals; but the wish is just as preposterous and futile as the wish of every soldier in the ranks to be an officer; of every child to be at once a grown man or woman; of every operative to be the wealthy manufacturer; of every boy to be a Grant, a Lincoln or a Washington. Leaving out the lucky few, let us look around among the great multitudes and see if we can better our condition by exchanging places with them. In the city of New York, with a population of over a million, scarce twenty thousand live in houses by themselves. At least one half of the whole population live in tenement-houses and cellars. There were, at the last census, sixteen thousand tenant houses, containing each an average of over seven families, in many cases an entire family occupying but a single room; and there is a story of an inspector who found four living in one room, chalk lines being drawn across in such a manner as to mark out a quarter of the floor for each family. "How do you get along here?" inquired the inspector. "Very well, sir," was the reply, "only the man in the farther corner keeps boarders!" And I regret to say that I have found many of the occupants of single rooms in tenement-houses in that city, farmers by profession, who, in the hope of making money faster, have sold their farms, deprived themselves and family of a home for their old age, and so far from bettering their condition, have dropped from bad to worse, until death has released them, and relatives or the public have removed their families back to the country or to the poor-house. Do you find the condition of the laboring classes in the smaller cities and towns advanced in comfort beyond yours? Do they work any less? Do they have any better houses—or any at all? Do they have more or better to eat or drink? As much leisure to ride about, for social converse, for self-improvement, for education of children? And have they the same certainty that farmers have of a final provision

for them left behind, when the portals of the grave open to receive the head of the household? As, according to the ancient philosopher, no man can be justly called happy whilst living, so no man's happiness can be measured by temporary wealth. Experience shows that those who have a regular business and moderate competency are the most fortunate; and if, in addition, they enjoy the full use of their limbs, are free from disease and misfortune, are blessed with wife and children, and *shall end their life well*, they may be pronounced happy.

This, then, is our position to-day. We are as comfortably situated as the more favored of the majority of mankind. We have an occupation rendered less toilsome every year by the introduction of machine in lieu of human labor; more profitable by the constantly increasing avenues of consumption; healthful from its very nature; keeping us amid heaven's breezes and pure air, instead of confining us in the fœtid atmosphere of towns or cities; an occupation so scientific that its capabilities are boundless, and only need the attention and intelligent conductors to extend its benefits far beyond its present limits, and not only conduce to our own personal welfare, but promote that of myriads present and to come. Now let us realize that the opportunity of the New England farmer has arrived. The whole world is clamorous for scientific labor. We are living, and shall continue to live, closer lives. Competition is to be sharper in all departments of industry; the lessons of the past are more searching and more exact. The line of demarkation between the cultivated and the uncultivated farmer will become broader; and as men get rich by the skilful direction of the labor of others rather than by that of their own hands, the uneducated farmers will have to do the drudgery, the poor-pay work, and be employed by those who have learned to think, and can make their head-work direct the hand-work of the less favored. If, as I firmly believe, it is to be the mission of the New England farmers to go forth as scientific teachers, and restore not only the once fertile lands of the West, but rejuvenate the soils of the East, it is time to unfold our arms and prepare for the responsibilities thrust upon us.

The whole country, and our State especially, is aroused to the necessity of having institutions especially adapted to the higher branches of instruction for farmers' sons; and we must not

only avail ourselves of these advantages, but be clamorous for more. There is no reason why in our common schools sciences which are the foundation of agricultural knowledge and practice should not be taught; why our girls, as well as our boys, should not learn the elements of a science by which, perhaps, they may yet rise to fame and fortune. Some one has said that God never made a man who was safe to be trusted out of sight of a woman, and certainly we are all the happier for keeping *them* in view and there is no reason why the coming woman, who is described as a bright-eyed, full-chested, broad-shouldered, large souled, intellectual being, able to walk, able to eat, and of course able to talk, will not assist in the management of the farms, and eventually usurp the business of raising small fruits for market, also vegetables, and flowers, and occasionally give such attention to raising stock as is not deemed unseemly by ladies of the best breeding abroad. And if these high considerations that I have set before you do not win your sympathies, let me assure you that education in your calling is the true road to riches. It is only by the ignorant that active capital acquired by their industry is unemployed in their business, and among the great advantages of scientific agriculture will be that of investing in it the moneyed capital which will be as productive as in other pursuits, and much more safely employed than if embarked in hazardous enterprises or doubtful investments. What Mr. Motley says of the Dutch Republic in its palmiest days is applicable to ours :—

"In proportion to their numbers they were more productive of wealth than any other nation then existing. An excellent reason why the people were so well governed, so productive, and so enterprising, was the simple fact that they were an *educated* people."

Now we claim to be an educated nation, but we cannot really become so until all professions and trades, not merely one or two or three, are represented by youth educated in all the special learning applicable thereunto, and each have a share and share alike in the sciences which underlie all business and callings.

The view that I present of the opportunity of the New England farmer is no wise chimerical. Scientific agriculture is hardly of half a century's growth, and in that time it has renovated nearly the whole of Europe. Agricultural schools have existed in the Old Country more than fifty years, and under the

new systems of husbandry propagated by their influences, profits have increased from 500 to 1,000 per cent. Great enterprises like the cultivation of beets for sugar in France, and its extension to Russia, through the means of educated agriculturists, imported for that purpose from the former country, have been fostered by the appropriate scientific knowledge, and the value of arable lands has increased two and three fold. In the little kingdom of Hesse, which, during our revolution, was so poor that its mercenary ruler sold his subjects to England as instruments of our attempted subjugation, land under the treatment of improved husbandry has risen in value three hundred per cent. But we need only to look around among ourselves to see what education in farming has done and is doing. We have been educated by these agricultural societies, by the farmers' clubs, by the newspapers, and every one of you who is taking up a specialty, such as breeding stock, raising fruit, or sending milk to the cities, is in a process of education, because it rouses you to study all the departments connected with your labors, and to apply all your energies to make the resources of your farm meet the demands for the article you raise or sell. But we all regret that in our youth, when we were pursuing our avocations on the farm, we had not the opportunity of studying the sciences so intimately connected with our pursuits, that we might now have the knowledge through whose application we could make our farms produce twofold more than they do, the pleasure which the prosecution of any undertaking whose *rationale* we understand always bestows, and the perseverance and method which are only given by precepts and principles grounded on demonstration. This is what our children want—not mere theoretical study, not a college education in the old sense, but an acquaintance with the physical sciences carried along *pari passu* with their work on the farms, thus combining the knowledge of principles with their constant application. In addition they want more from us than mere bed and board and a chance to work hard. They need our sympathetic encouragement, our instilment of the belief that agriculture can be the noblest employment of mankind, an application of all the knowledge we possess or can acquire, and at the proper season an appreciation of their efforts by a partnership or interest in the profits of the farm. By this course we shall be co-workers in raising up a

class of scientific practical agriculturists, who will be prepared first to be successful in a moderately bad climate and a comparatively sterile soil like that of New England, and eventually to stem back the tide of slovenly cultivation threatening to overwhelm us in the West, and raise our country to its normal position of the leading agricultural country in the world.

The mottoes of our country are emphatically, Peace and Labor. We desire to be at peace with all, and to provide the means of support by honest labor to all. We claim that labor, whether of the head or hands is alike honorable, and that more true glory is won by increasing the fertility of the earth, by the invention of implements which lessen the toil of the hand workers, than by creating new engines of war, or even using them successfully against our fellow-men. Sir William Jones in an eloquent panegyric, nearly a century ago, said, "He who makes two spears of grass grow where but one grew before, is a public benefactor far in advance of the noblest chieftains, who aided by armies and the enginery of war, sack cities, carry conquest onward only to conquer, subjugate and desolate kingdoms." If that sentiment was true of the art of agriculture in its infancy, how much greater will be the glory of those, who, aided by the experience of the past, educated by the schools of the present and future, shall not only make two, but dozens of spears of grass grow where but one grew before, shall restore by scientific effort the fertility of the ravished soil of the virgin West, and double and treble the products of the exhaustless farms of the older sections of the country. Of these efforts it may well be said :—

"The plough and the sickle shall shine bright in glory,
When the sword and the sceptre shall crumble to rust,
And the farmer shall live both in song and in story,
When warriors and kings are forgotten in dust."

THE FARMER'S CONFLICT.

From an Address before the Norfolk Agricultural Society.

BY GEORGE B. LORING.

The day of instinctive, traditional agriculture and spontaneous crops has gone by, with us at least. We look back with astonishment upon the time, when, unaided by science, the practical mind of man seized hold of the most successful methods and accomplished the highest results. What do we not owe to the past generations of the working farmers? It is they who have discovered that remarkable system of drainage by which the hard and unyielding bed of clay becomes, through the agency of a simple circulatory tube, as obedient to the hand of the cultivator as the warmest and most fertile loams. They have brought out of wild and useless classes of plants the nutritious grains and luxuriant fruits which nourish and delight. They have seized and tamed the species of animals adapted to their wants, and have produced every variety of breed which diversity of soil and climate and market may require. The heavy Shorthorn makes haste to repay them for his food by a rapid production of beef. The hardy and patient Ayrshire devotes all her faculties to an abundant supply for your dairy. The clumsy draught horse learns readily the duty which has been imposed upon his phlegmatic family. The racer and the roadster are ever alert in the service to which you have specially assigned them. You have learned the capacity of your lands, and understand what fertilizers they require, as well as you know the food which will best nourish your domestic animals. You have discovered how to subdue nature, and go forth to the first step of the process with axe upon your shoulder, as confident of the result of the contest as if the blooming fields were already before you.

Out of this number of practical men came Cavour, who, in the intervals of his public life, was the most successful farmer of modern Italy; and Mechi, whose practical operations, as recorded, have become one of the text-books of farming; and Marshall, who learned to manage his own lands, and who declared that "attendance and attention will make any man a farmer;" and John Johnston, who has taught us all how to raise wheat on drained lands; and Parmentier, who was obliged to turn farmer before he could overcome popular prejudice and introduce the potato into France. From among their numbers have come the clear-sighted, quick-witted workers, who have made immediate application of every good suggestion, and have brought agriculture to a high standard. To them belongs especially that class, who, having acquired their knowledge, reproduce it in some useful form for the practical benefit of mankind; that class whose minds are not so burdened with theories, that when the moment for action comes, they lose sight of the very object for which their theories were constructed.

It is to such as these that we owe the early construction of our social and civil fabric, and the existence and early prosperity of our country. They were thriving farmers, and with the exception of a limited commerce, they held in their hands all the resources of our country. They carried our country through the Revolutionary war—"the embattled farmers," as the poet calls them. Year after year they toiled on, clad in their household manufactures, laboring on the soil with their own hands, by prudence and economy constantly increasing their own wealth and developing the wealth of the republic which they had founded. They led lives of usefulness, and left behind them, on every hillside and in every valley in our State, the broad and thrifty farms which even now bear witness to their sagacity in selecting land and their skill in cultivating it. They had neither agricultural school nor society nor newspaper to guide them; and were they alive to-day, they might well inquire why all this intellectual effort is put forth to accomplish what they accomplished simply by obedience to the natural laws of earth and sky.

Now, if we have what they had not, they had what we have not. Their soil was as fresh and fertile as the vegetable and mineral accumulations of centuries could make it. They required but

little manure. Their staple crops of corn, potatoes, grass and small grain were abundant, in favorable seasons. A record carefully kept in Essex County shows that in the early part of this century, there were raised to the acre, 28 bushels of wheat, 117 bushels of corn, 52 bushels of barley, 518 bushels of common potatoes, 900 bushels of carrots, 1,034 bushels of mangel-wurzel, 688 bushels of swedes, 783 bushels of beets, 654 bushels of onions; thirty tons of hay grew on six acres, and the yearly average of forty acres was, for many years, more than 120 tons. Their pastures were luxuriant; and the abundance of sweet grass enabled them to feed with considerable profit, animals whose excessive carcasses rendered a liberal supply of food imperatively necessary. Their wants were few and simple, their labor was cheap, their markets were seldom overstocked; and they followed the advice of Dr. Putnam in our day, and resolved "to stay at home," because they had no convenient and rapid means of getting away. They had but little book-farming, and that little was of such a description that it secured their contempt rather than their respect or admiration. Their conflict was comparatively light, and their victory comparatively easy.

Now, however, new difficulties beset our path—difficulties which must be met by systematic and methodized farming in order that they may be overcome. The soil of the older States, and already too much of the soil of the newer ones, has become exhausted by constant cropping. The natural productions of the earth are diminished; and crops which grew luxuriantly with easy cultivation a century ago, now require the most careful husbandry and a judicious application of manures. An acre of land in Massachusetts to-day, will probably absorb in cultivation for most crops, five times as much money, in labor, cost of manure, cost of seed and interest on capital, as it would fifty years ago. The business of fertilizing has become a most important one. The difficulty experienced in obtaining barnyard manure, the cost of transporting so bulky a material, and the labor required in handling it, are now serious obstacles in the way of using this manure at all—obstacles which our ancestors hardly considered. And all the chemical ingenuity of man is employed in finding a substitute.

The cost of food for cattle, and the deterioration of our pastures, combine to render the business of cattle-feeding one in

which the wisest calculations must be made, and the most skilful selection of animals, if we hope for any reward. It would be impossible to reap any profit from the misshapen animals of the last century, fed in barns when hay and grain command the present market value, or on pastures whose herbage has been reduced in quantity and perhaps in quality by long feeding. It has been found necessary, therefore, to create animals adapted to the rapid production of beef in order that a pound of meat might be obtained with the lowest possible consumption of food. Modern skill has accomplished this, and it has also provided us with an animal for our dairies, capable of furnishing large returns in milk for the amount of food consumed, and capable also of providing for herself easily and rapidly on a short pasture.

The demands of the markets have materially changed within the lifetime of many now before me. Within a few miles of our cities and large towns, the market-garden is the chief source of profit to the farmer, and in supplying this he is obliged to adopt a system of rapid husbandry unknown in this State not many years ago. Early potato crops, vegetables grown under glass, and the early products of the garden, forced into almost premature existence, now take the place once occupied by corn, and grain, and hay, in the list of what the farmer sells. In order to meet this requirement of the market he must exercise a kind of skill wholly unnecessary in the production of the staples of trade.

The raising of fruit, too, was once as simple as the planting of a forest-tree. In order to obtain an abundant supply it was only necessary to plant trees—and wait with patience a few years. The apple was at times a drug in the market; peaches were allowed to decay on the ground where they fell from the overladen trees; plums were easily raised in abundance; all with but little care and at little cost. But now the earth is encumbered with "barren trees, decayed and dead;" the curculio destroys the plum; the yellows extirpate the peach; the caterpillar, and canker-worm, and burrowing maggot, and cere-worm blight the apple in every stage of its growth, and ingenuity and science are exhausting themselves in endeavoring to ascertain the surest and most economical way of destroying the pests.

It is the careful and economical application of fertilizers and

labor to the soil for special crops, provided for a local market, the selection of animals adapted to the land on which they are to be fed, and an effectual and inexpensive war upon the destroying insect tribes, that occupy the attention of the successful farmer of our day. Add to these the cost of labor and the expenses of subsistence, and you can easily understand that his work is by no means easy.

To enable the farmer to meet and overcome these obstacles, we appeal now to science and invention. Agricultural education has become one of the most important questions of our day —how it shall be conducted, and in what it shall consist. An accurate knowledge of the best systems of husbandry, an understanding of the structure, habits, health and diseases of animals, a capacity to analyze and apply manures, skill in the manipulation of soils, an intelligent comprehension of what lands to drain, and what to avoid, are deemed now to be the object of an agricultural education, and indispensable to successful agriculture. The plastic, receptive, and inquiring mind also, which is created, or should be, by careful mental culture, the mind ready to give and receive, quick to forget all prejudices, and throw over all unfounded notions, has a great work to perform in elevating agriculture to its proper standard, as a useful and profitable employment. Industrious, ingenious and open-minded farmers are what the times demand, and what societies and clubs and colleges create.

To enlighten the agricultural mind, therefore, and strengthen the agricultural hand, we appeal to our educators and inventors —and we do not appeal in vain. The zeal with which agricultural investigation is pursued, and the increasing desire for knowledge manifested everywhere, indicate not only a thorough understanding of the magnitude of the conflict, but a determination also to be victorious in the strife. And this incessant and untiring invention of machinery—what does it all mean, but that the old weapons are unfit for the toil, and have become powerless amidst the difficulties and trials of the present age. As it is, the ingenuity of man exhausts itself for us. The wheel, the pully, the lever, centrifugal and centripetal forces, every corner and angle are brought into the construction of machinery to aid us in subduing a hard and obdurate soil, and in gathering in our crops. In nothing is the profound interest of man

in the great art which feeds and clothes him made more manifest, than in his constant endeavors to strengthen the hands of those engaged in it. If you would estimate the true value of all this effort, strike down for a season your societies and clubs, close the doors of your schools and colleges, lay aside the inventions of labor-saving machinery, and returning to the scythe, the hand-rake, the flail, and the wooden plough, call upon the East to gather its crops, and upon the West to send its seas of grain to market, and see what answer you would get to the call. So earnest do I consider the demand for agricultural education in the popular mind, that I have no fear for the success of all institutions devoted to this purpose. And I cannot doubt that the application of machinery to the cultivation of the soil, will one day become as accurate and effective as it now is to manufactures and the mechanic arts. I would have agriculture a triumph of skill. Man cannot control the elements, I know; the drought will wither his tender plant, the floods will drown it, the frosts will nip it. But relying on the great promise that seed-time and harvest shall not fail, he can exert all his powers to success in that conflict to which he was doomed, when the decree went forth that in the sweat of his face should he eat bread.

In presenting this view of the agricultural effort of the present as compared with the past, I find myself suddenly arrested and called back to the tastes and traditions of the long line of hardy, industrious and prosperous farmers from whom we sprang. We must enter anew upon our new career, but we may not forget the laws by which they subdued the earth, and which have gone into our text-books of farming. We should not forget their modes of cultivation, by which they raised extraordinary crops, nor their attempts to improve the animals upon their farms. And we should remember that it was they whose strength civilized these hills, in whose hands the material prosperity of our State rested half a century ago, whose ample abodes still remain in our villages and along our roadsides, whose social position was won by solid merit, who constituted that intelligent rural population from whom the merchants, and lawyers, and divines, and statesmen of our day have sprung, and whose homes are still waiting a return of that wealth and intelligence which long ago deserted them. In our busy and

restless and ambitious life we have poured our best powers of mind and body into our cities and towns, and exhausted them in the forum, or in the hard toil of the inventive arts. We have forgotten too much the old rural homes—those broad fields, those overshadowing trees, that substantial New England dwelling, whose very presence even now tells of the staunch and reliable virtues of those who have long since gone to their rest. We should know that the charm of life is not in our cities and large towns. Neither our moral nor our religious nor our physical natures can be developed with that beauty of proportion of which man is capable, so long as we prefer the feverish excitement of the busy concourse of men to the healthy and refining influences of a cultivated rural life.

There are charms in the increasing current of life which flows through the farm and the market-place. There is a fascination, as Mr. Choate once said to me, "in the newspaper and the post-office," above the quiet of a country life. But when we remember the annoyances which meet us at every corner, the petty strifes of men, the struggles and distresses, the efforts and disappointments, shall we not sigh for the rural respectability of our ancestors, and exclaim with Cicero, "There at my Laurentium, I hear nothing that I repent to have heard, say nothing that I repent to have said; no hopes delude, and no fears molest me. Welcome, then, life of integrity and virtue." We must learn to love the land, to love it as our fathers loved it, to love it as the people of old loved it, whose great men enjoyed their favorite retreats, and listened many a returning spring to the nightingales that tenanted the dark ivy, and greeted the narcissus, ancient coronal of mighty goddesses, as it burst in beauty under the dews of heaven. When from our New England cities, which have received their life-blood from the country, there flows back a current of wealth and intelligence to beautify our towns and cultivate our fields, we shall make our land still more the fit abode of a free and intelligent people.

AGRICULTURE IN MASSACHUSETTS.

ESSEX.

Essay by Warren A. Durant, of Lawrence.

When we consider the number of societies that have been formed in this Commonwealth by the tillers of the soil for mutual encouragement and improvement, the variety and large circulation of periodicals devoted to their interests, the machines and implements which the inventive genius of the day is producing to lighten their labors, the superiority of modern farm buildings, the new fruits and vegetables which are yearly offered to the public, and improvement in all kinds of stock, it is natural to infer that our agriculture is progressing rapidly, for are not all these things sure indications of a deeper interest, more careful study, and a higher success?

It is true there has been a great advance in the ways and means in farm management, that never before did farmers manifest so strong a desire for thorough, accurate knowledge, and and never were so many educated men devoting their time and talents to its elevation; but amid these cheering signs of progress are others of a different character, which give another view to the subject. Ride about any county, traverse the length and breadth of the State, and the traveller may go a long distance without seeing a single work of permanent improvement in progress. Occasionally he will find a man subduing meadow land, or breaking up a rough pasture, but not in a strong-handed, energetic way, as if he were positive of the utility and profitableness of his labor. Here and there he will see new buildings. The fact that the old ones are tumbling down is as often the cause of their erection as the pressing necessity of enlarged accommodations. If he examines every farm carefully, he will be surprised at the number where the pastures are growing up to bushes, briers and brambles, where mowing fields need to be

renovated, where the crops suffer for want of thorough under-draining, where a majority of the fruit-trees are upon the decline from old age or neglect, where walls and fences require rebuilding, and the buildings are behind the times and rapidly going to decay from lack of timely repairs. A large portion of the farms are owned by people who have passed the meridian of life; their children are grown up and gone; under increasing years and increasing infirmities, what was once to them a pleasure has become a burden. Short of reliable and efficient help, they adopt that course of management which involves the least care and labor. These men can tell you of the larger crops this farm has produced, or the greater number of stock which that one kept, and freely admit the backward tendency of their own homesteads. The simple fact that none of the children can be induced to assist in carrying on the farm, causes scores in every county to be thrown upon the market for sale. Everywhere can be seen field after field that does not pay interest, taxes, and cost of maintaining fences. Scarcely a beginning has been made in thorough drainage, and yet the wet lands, which constitute no small portion of the area of the State, can be rendered the most profitable of any in proportion to labor. Thousands of acres of hillside, and rough, rocky lands, which have been stripped of their natural product, the trees, and are now kept for a sort of pasturage, would return a higher percentage if they were at once converted into vigorous young forests. It will be seen, taking the State as a whole, that the number of farms which show a steady increase in productions is not large, and all that can strictly be called progressive in her agriculture lies in improvement in *quality;* that, notwithstanding the numerous appliances for saving labor, the *quantity* of products has not been increased during the last twenty-five years.

If any one wishes further evidence on this conclusion, he can turn to the statistical record, and there he will find that the State had in 1845, 52,541 more cattle than the returns show for 1865; there were 185,509 more of sheep—the falling off being principally in the Merino blood; there has been a decrease of 41,519 in swine. The horses, however, are more numerous, there being a gain of 25,101. This gain may be attributed to farmers substituting horses for oxen, and to the larger numbers required in cities. The corn crop in 1845 was nearly as large

as that of 1865, the difference being only 1,470 bushels; the increase in barley is 16,664. The hay crop shows an increase of 19,189 tons, while, during the same period, wheat fell off 7,206; in rye, the decrease is 176,512 bushels; in oats, 572,162; in potatoes, 940,575 bushels. In 1845 there was made 3,410,045 pounds of cheese more than in 1865. The butter sold from our farms at the latter date was 3,892,766 pounds, which is nearly four million pounds less than the product in 1845. Some decrease might be expected in the dairy, since selling milk is taking precedence of butter and cheese-making, but neither the increasing demand for milk, nor the high price of butter and cheese have prevented the number of cows from diminishing, for the returns at the last decade show a loss for the State of 9,624, and of this the share of the leading dairy county, Worcester, was 3,890.

It may be suggested that this diminution in stock and staple products may partly be accounted for by the increasing attention given to horticulture, the raising of raw material for our manufactures, and by the absorption of some of our best land into house-lots and suburban residences. In answer to this, it may be stated that the market gardens are mostly confined to the three counties encircling Boston, and flax, broom corn and tobacco are the only articles raised that are not strictly edible, and that the whole area devoted to these three articles, and also to market gardens, is only 9,891 acres, which would not account for the deficiency in the oat crop alone allowing a yield of forty bushels to the acre.

The question may here well be asked, why, while our commerce and manufactures have achieved unparalleled success, our agriculture has not likewise prospered? Is it owing to a lack of enterprise? The past twenty-five years have in some respects been trying times to our farmers. It has been a period of changes, and to keep up with the advance of the day has required a succession of radical changes—in the kinds of crops—in modes of cropping and cultivation—in the introduction of labor-saving implements—in the system of marketing and means of transportation; and while striving to keep up with these they have been contending in sharp competition with the first fruits of the richer soil of our younger States. Moreover, a spirit of discontent has prevailed; said some, the lot of our Pilgrim

Fathers did not fall in a goodly place; the promised land of the western world lies beyond in the great valley; why delve we here amid these many hills, rocky fields and stertile plains? let us go and possess it! Others said, money can be made easier and quicker in the factory, the workshop, or counting-room, and we will go thither! Our business men have spoken contemptuously of tilling such a soil as this; Eastern capitalists largely interested in Western railroads and in the sale of lands, have urged on emigration from our rural districts; every man thus withdrawn from the farm is a material loss to our agriculture. When the ranks of our farmers have been continually thinned by the removal of the young and robust, what could our old men do? Where was the encouragement for them to remodel their buildings, buy labor-saving machines, smooth down their rough fields, underdrain and adopt all the new improvements of the day? Where would our manufactures be were it not for the young men crowding into every department ready and willing to rise early and bear the heavier burdens, and who have the courage and spirit to try the new projects? If under such circumstances our farms have held their own, they have done well; if they show a decrease it is not surprising.

It is well known that the production of food in our State is not equal to the consumption; and from the foregoing it will be seen we are less and less able to meet the demands of the yearly increasing population. Our markets are so regularly supplied at all seasons of the year that it is difficult to tell how much comes from within and how much from without the State. A simple enumeration of the sum total, either in pounds, bushels, acres, or their value in dollars, does not always give a full idea of the quantity our farmers have to sell, or the real productiveness of the soil. A few equalizations and comparisons, however, may help in attaining an approximate idea. The wheat crop for 1865 gives but a trifle over one quart to each inhabitant, and if to the wheat the rye, barley and buckwheat be added, it would give 11.4 quarts to each person; still add to this the whole corn crop, and there would be 1.9 bushels of grain whereof each inhabitant could make his bread. The potato crop, divided equally, gives three bushels to each; but of the whole crop, so small a portion comes to market that our cities must obtain a part of their supply from other States.

There is only one cow to every nine people to supply dairy products; the cheese made gives a fraction over three pounds to each. Boston, with its present population, would find in all the butter sold from the farm about sixteen pounds to each person. It has been argued by some that fruit culture would be overdone, and that even now apples do not pay; yet within the last few years we have imported largely of all varieties, and if the amount of what has been brought into the State, both fresh and preserved, foreign and domestic, could be ascertained, without doubt it would exceed all which has been sold from it even in our most fruitful years.

An average of the hay crop gives each farm 13.2 tons; the oat crop, 14.2 bushels; corn, 42.3; potatoes about 81 bushels; the wheat less than one. The English hay, divided among the horses, cattle and one-fifth of the sheep, is 1.3 tons to each animal; add to the English the meadow, both salt and fresh, and they would make 1.7 tons. The oats and corn fed to the horses alone, in daily rations of six quarts, would last one hundred and fifty-six days. If the horses were divided among the farmers, they would have 1.9 each; an equal division of the sheep gives 3.4; of swine, 1.3; cows and heifers, 3.7; of all the cattle, 4.7. Or, to proportion the stock to the population, there was, in 1865, 5.6 people to each head of cattle; 7.4 people to each sheep, and 20 to each swine.

In 1860, the United States had 1.5 people to each sheep; 1.1 to each head of cattle, and less than one to each swine. There are obvious reasons why Massachusetts does not keep up with some of the younger States in stock-raising, but is there any reason why she should fall so far below the average? Our State is not so well stocked as many foreign countries, where a great deal is said about land monopoly, excess of population, slow progress, &c. In Great Britain there were 3.5 people to each head of cattle; France, 2.6; Holland, 2.7; Sweden, 2; Russia, 2.9. France had 1.1 population to each head of sheep; Prussia, 1; Spain, less than a unit. Spain had 3.6 people to each head of swine; Great Britain, 7.6; France, 7.1; Austria, 4.4.

Although the excess of the consumption of food over the production is large, no one acquainted with successful farming will doubt that the present and even a larger population could be furnished with food from our soil, when its real productiveness

has not yet been developed. Thousands of acres of our best land lie waste, or yielding at most a stunted growth of wood or a little coarse hay and sour grass. Our farmers returned nearly an acre of unimproved land for every acre of improved. Now if one-twentieth of the unimproved land were planted in corn, it would give, at thirty bushels per acre, a gain nearly equal to the present crop; if another twentieth were sowed to rye, at twenty bushels per acre, the crop would be about four times the present one; a twentieth in barley, at twenty-five bushels per acre, would give more than eight times the present crop; one-twentieth in wheat, at fifteen bushels per acre, would be 773,130 bushels, or about sixteen times the amount now raised; one-tenth in oats, yielding twenty-five bushels per acre, a crop four times the present; two-fifths in hay, at one and one-fourth tons per acre, and the hay crop would be doubled; if the remaining five-twentieths were brought into good pasturage, and two acres made to support a cow, more than 125,000 of this valuable and profitable part of our stock could be added to our present number. Large as the products would then appear, who will say the maximum point would be attained; for the average yield of the acres now termed improved could be easily raised twenty-five per cent., and still be below what it produces under the management of our best cultivators. That greater progress in our agriculture can and ought to be made, none will question; but are the tillers of the soil, under present circumstances, able to bring it up to the desired standard? If all the means within their reach are persistently and faithfully used, the prospects are encouraging. The transition state through which they are passing will soon be over, and things settle down to a more permanent basis. The work they have to do, and the best manner of doing it, will be better understood; and it is to be hoped that ere long the migration from the farm will be checked. It was an important step towards progress when an institution was provided for educating our young farmers for the work they are to assume. Hitherto the existing means for acquiring that education were inadequate to the exigencies of the case, and all plans proposed to meet the deficiency failed to receive the hearty approval of those who were to be benefited thereby. Teaching the agricultural sciences in the public schools would only give a smattering of the rudiments; and, judging from the past, lit-

tle direct, practical aid could be expected from the classical colleges. The canker-worm and caterpillar may devastate the very trees that shade their grounds, the curculio and mildew destroy their fruit, rust, blight or rot their potatoes and other vegetables, yet they pause not, swerve not from their routine to discover, if possible, practical and effecutal remedies against these and kindred pests that continually harass the farmer. Digging out Greek roots, discussing knotty points in metaphysics or ancient history, or discoursing upon heathen mythology, are more congenial occupations. The effect of the training of our classical schools seems to be adverse to fitting a young man for following the quiet, laborious life of the farmer. Were it not so, why do so few graduates immediately choose this as their future and only avocation? Were an attempt to be made to teach agriculture in our scientific schools, the other industrial pursuits having a stronger hold upon the sympathies of our citizens, it would be crowded into the background, and would not receive the attention its importance demands.

Therefore all honor to the men who decided to establish a distinct, separate and independent college for farmers, and who located it in a purely farming district; there it can stand upon its own merits, and work out in its own way the agricultural problems of the day. It was a bold movement; few States have had the courage to do likewise. But the exigencies of our farmers required it, and their sons can fill it to overflowing, and it can be made an institution of incalculable benefit to the whole State.

In the great work before them, farmers need the aid of the legislature and the hearty coöperation of the public. To this some manufacturers may object, and say we create new and better markets; if agriculture does not thrive under the stimulation of these, let it decline. Other men may claim that any special grants, privileges or aid from the public will be construed as favoritism, and may form a dangerous precedent; for agriculture is only one of our many employments—merely a specialty. But have not our manufactures and commerce been constantly under the patronage of government, and are they either more than a specialty? Our manufacturers saw from the beginning that protection was necessary for their very existence; they sought it, claimed it, and obtained it; and even

now their great prosperity is due in large measure to the fostering care of government. A few merchants, finding that Boston would be benefited by a larger traffic with the West, at different times determined to open new thoroughfares across the State, and they asked for aid; it has been freely granted. Most faithfully and zealously has the State watched and guarded the mercantile and manufacturing interests. So far has legislation sometimes been carried to advance these interests, that the rights of farmers have been ignored. It would not be an act of generosity if the helping hand of the State were now extended, and an effort made to raise agriculture to the position it should occupy; it would be simply justice, or the recognition of rights; for farmers have rights—by the virtue of the property they own, taxes they pay, and votes they cast. When we consider how cheerfully they have submitted to—nay, often cordially supported—measures for the advancement of our varied industry, it is surprising they have not asked more for themselves; and when they see how these have advanced with rapid strides, while they have been stationary or retrograde, what shall be said? Were the 46,904 owners of farms and their 68,636 employés united upon any plan, their requests would certainly be heeded.

But the desired end may be secured without one class of citizens arraying themselves against another; the interests of all classes are in the main identical; every man, woman and child in the Commonwealth, has an interest in any project which will improve the quality and increase the quantity of food. Our manufacturers, from their peculiar location, will think more of this subject in future, for they soon will meet with sharp competition from the rising establishments at the West and South, and they will find it quite enough to transport coal and raw material to this corner of the Union, and carry their goods or wares to distant markets, without sending a thousand miles or more for provision for their workmen. They must have some material advantages in order to continue to make their profits; one of these should be cheap labor; cheap labor depends upon cheap food, and where shall they obtain the cheap food? Shall it be from our own fields, or from the West? If from the West, Western manufacturers will have it still cheaper. It has been a pet theory with many of our leading men, that it is cheaper to bring provisions from the West, than to raise them from our

own soil, and an enormous expense has been incurred in opening various lines of communication with more fertile lands; still, the price of staple products has steadily advanced and the markets in and around Boston, are the dearest in the Union, for purchasing food, if we except the mining districts. This will continue to be the case so long as the acres within our own limits and within full view of our workshops, are neglected and we depend upon localities far away. Bushels are bushels, barrels are barrels and tons are tons, and it will require as much force to move them thirty years hence as now, and the older, richer and more influential railroad companies grow, the less disposed are they to carry for low rates. The true working of this plan will ere long be apparent, and it will be seen that if some of the State's money that has been furnished for the construction of railroads to carry it into execution, had been expended in the promotion of our agriculture, it would prove a better investment. After all that may be said, our manufacturers, in reality, are sensibly affected by the prosperity of the farmer; they desire our markets to be cheaply supplied with provisions in abundance. If our farmers will now develop their resources, show the capacity of the soil, and their ability to furnish the markets, every plan for the promotion of agriculture will be promptly seconded and supported. Were there no higher motive, a State pride should prompt every citizen to speak a good word for the advancement of this important branch of industry, for will it not be gratifying as we travel from town to town, county to county, through the length and breadth of the State, to see the rough fields made smooth, the waste places productive, all the steep, bleak hillsides again clothed with trees, valleys full of waving grain and well-kept flocks and herds, and every acre producing its full quota,—to see around the home of every farmer unmistakable evidence of contentment, happiness and prosperity!

FARMS.

ESSEX.

From the Report of the Committee.

Notwithstanding the urgent calls of the committees, and the liberal offers of the society for the last few years, the number of farms entered for premium is by no means increasing. The general business of farming which prevailed until a recent period, and which developed some of the finest specimens of mixed farming in the Commonwealth, is now displaced, to a considerable degree, by a special attention to particular crops, or by a tasteful improvement of valuable estates. The production of garden vegetables for the market, both early and late, occupies the attention of most cultivators residing near our large cities. And as the wealth of our county increases, the number of elegant residences, ornamented by landscape gardening and surrounded by fields subjected to expensive culture, increases also. Meanwhile, the farms which were once managed by husbandmen, who took pride in their working oxen and dairy herd, in their ample fields of corn and grass and potatoes, in their orchards bending beneath the weight of fruit, and who sent beef, and hay, and pork, and butter, and cheese, and apples, and cider, to the market, are fewer than they once were, and are not, in many instances, conducted with the industry and skill of former times. While this change in the condition of agriculture has been going on, agricultural emulation and rivalry have declined, and the business of horticulture has become more prominent.

The importance of encouraging this modern system of farming should not be lost sight of. The devotion of lands, in small parcels, to special crops, is especially necessary where a large portion of the population is occupied in mechanical and manufacturing operations, and own no land, raise no vegetables and fruit for their own consumption, and should find a well-supplied market. Vegetables and small fruits are produced in such lim-

ited quantities that they are a luxury, beyond the reach of many of the laboring classes. This state of things should no longer exist. And we urge upon all owners of land special attention to those crops which are required in the markets of our manufacturing and commercial towns. We trust, moreover, that the competition among small farms devoted to this object will increase, and that committees will hereafter be called upon to examine and report upon numerous entries of this description.

The only farm entered for premium this year is the estate of Dr. E. G. Kelley, of Newburyport. The careful management and cultivation of this tract of land (about sixteen acres,) were a source of great gratification to the Committee, as an illustration of the ample reward which a skilful cultivator of trees and fruits will receive, even in a few years, and of the advantage to be derived from proper preparation of the soil, and from the destruction of weeds, and the appropriate use of fertilizers.

The following statement of Dr. Kelley gives a clear and admirable account of the processes to which we have referred :—

Statement of E. G. Kelley.

In presenting a farm for premium, the following are the printed conditions : " For the best conducted and most improved farm, taking into view the entire management and cultivation, including lands, buildings, fences, orchards, crops, stock and all other appendages, with statements in detail relating thereto."

Our management and cultivation of lands has been to underdrain about six acres with tiles, transported chiefly from Albany, N. Y., and laid more than three feet deep on an average ; to surface-drain five acres not admitting of tile draining ; to subsoil two acres twenty-two inches deep ; to trench three feet deep, four acres in all, at different times, as labor could be spared from other work ; and for some years the trenching was being done nearly all winter.

Hundreds of loads of clay have been moved to divers places, and thousands of loads of sand and yellow loam have been carted on to and mixed with clayey soil, or used for top-dressing or for levelling and grading. The land thus worked has been so much improved as to produce almost anything in perfection adapted to the climate.

Cultivation on this place having been decidedly bad for more

than half a century, a change was of course made. Your Committee well know how a farm runs to waste and weeds when conducted by others than the owner. The previous proprietor died in 1806, leaving the use of the estate for the support and maintenance of a daughter, who at length died in 1852, when we purchased it. A more dilapidated, neglected and exhausted Sahara could not well be found.

To give minute details of every renovating process could not have been intended by the requisitions. We will therefore only cite a few operations. Weeds were exterminated in time by not allowing any to mature. Grass was cut early for the best hay, particularly if it contained "white weed," which, being propagated by seed, was thus yearly lessened. "Dog grass" and other noxious perennials were completely eradicated from arable portions by thorough digging up and securing their roots. All annual weeds were uniformly raked up, but were never saved for manure. We were consequently soon troubled by succession only from seeds wafted from the premises of our otherwise good neighbors, or deposited by the numerous birds. Moreover, we seldom used any manure besides wood ashes—the best nutriment, by the way, for all vegetation, and free from weed-seeds.

Tilling the soil was early, frequent, superficial or deep, according to circumstances. Trenched or drained and subsoiled land can be worked quite early in the spring, and does not require to be often repeated during the season, and *vice versa.* Continual growth and successful crops, notwithstanding drought, are also sure and gratifying, as well as the annual saving of labor. Properly prepared soil, planted, and free from weeds, receives, therefore, but little subsequent stirring, and that chiefly for hilling. We plant potatoes, corn, &c., in drill-rows, the former six or eight inches apart in the furrows, and at the usual time of hoeing form the continuous hill row, and turn back the same soil in the fall with the plough, thus obtaining more produce with given land and labor.

Of the buildings: the house—not built by modern hands but in 1776—is fifty feet square, with white oak frame, high-studded, and filled in with bricks, and having been modernized inside and out, is now faultless. We built a barn same size, the most economical form, and most convenient for interior arrangements. The ample cellar is a substitute for out-houses;

and we would build another barn, or even larger, if necessary, to contain all carts, implements, &c., too often left unhoused, or more or less exposed to the weather in sheds.

We removed at once all division fences, and have only the boundary line fenced. Some three hundred feet of this has stone posts set five feet in the gravel ground. Another, four hundred feet, has large stones on the surface of clayey soil, ten feet apart, with one and a half inch iron posts sulphured into drilled holes; and these, together with the rails and slats, rise and fall with the freezing and thawing clay. This novel and useful fence, and that of the stone posts, give great satisfaction. A live fence of the honey locust is also being tried. Other fences are of the usual varieties.

An old apple-orchard has been rejuvenated by draining, trimming and grafting. Several trees grafted with the Hubbardston Nonesuch bore so profusely as to destroy their vitality. We have forty varieties, many of them on paradise stocks, which gives a smaller tree but larger fruit. Many pear-trees are also in this orchard.

The exclusive pear-orchard is well drained and trenched, with horn-piths thrown in from one to three feet below the surface, as a permanent phosphate manure. We have seventy-five varieties of the fruit, comprising the kinds we think worthy of cultivation. Each year, however, we think more of standards and less of dwarfs. The former, particularly of the Lawrence, do as well in grass ground as the apple-tree.

Crops have not as yet been raised to sell, with the exception of hay, which, on the prepared land, is fourfold compared with former cuttings. Crops for domestic use are grown—corn and carrots for horses, turnips and beets for cows. All are in abundance and indispensable.

Stock generally consists of a pair of horses and two cows. The latter have been "soiled" during the summers for three years, and the practice is quite satisfactory. They are contented, thrifty, give more and better milk.

"Other appendages" with us must be trees, hedges, ponds and glass houses. Of the former there is a supply, and evergreens predominating, they have naturally given the name to the place. So numerous are they, that they protect each other and all about them. As screens, to secure and perfect fruits,

they are of great service, unless the source of too much dampness. It is incredible, to an unobserver of the facts, how perceptibly masses of trees affect temperature and moisture. Where land is plenty and cheap, it is singular that groves and screens are not oftener planted.

Where trees are trimmed to hedges, they become ornamental divisions or borders, are easily cared for, and add much to the value of any place. We have hedges of the Norway spruce, hemlock, arbor-vitæ, holly, weigelia, honey locust and cornus sanguinea.

Artificial ponds, like hedges, on a place called a farm, may be viewed by some as superfluities. To others they are a great source of pleasure, and not unprofitable. We long since discarded the dunghill fowl as too troublesome, and find water fowls more remunerative in themselves, while they decoy valuable wild game instead of hawks. The question has also been settled by cultivators of fish, that an acre of water surface may be made to pay better than an acre of land merely.

Glass houses also compensate, except to the exclusively utilitarian, whose income is only in dollars and cents. We have been many years building three of these, thereby obviating much extra labor, and at the same time have some of the most scientific and convenient structures in the country, unsurpassed for the purposes intended. We thus have employment for self and family the year round, and with only one man for help, quite enough of a good thing—care.

It might be deemed presumption to present a farm of sixteen acres to the consideration of your Committee, had not one of only fifteen been offered and accepted last year. It is, however, on the idea of "ten acres enough," "a small farm well tilled," and the like, that it is undoubtedly justified.

Our profit and excellence, if any, have not been in the many acres carried on by numerous hired men, with a list of merely profitable and perhaps forced crops, without annual and permanent improvements. On the contrary, we have only put in practice our theory, advanced some twelve years ago, in the annual address before the society, on Home Improvement.

We have perfected a few acres, doing the right thing at the right time, and added so much to their nominal and real value for the comfort and tastes of life, that for the original outlay

and subsequent expense a present market price might show a profit not exceeded by any other land operations.

For the Committee.

WM. SUTTON, *Chairman.*

BERKSHIRE.

From the Report of the Committee.

Your Committee received great pleasure, and no little profit, in the critical examination of the farms submitted for their inspection. There was great variety in their location and natural capacity, as well as in the ends proposed, and the skill displayed in accomplishing these ends. Some were adapted and appropriated to the dairy almost exclusively, others to fattening stock, and others still to a mixed husbandry. All exhibited points of excellence, and in some, we are sorry to say, we found marked defects; but, as a whole, we were more than ever convinced, that our county is second to none in the State, in the natural capacity of the soil, and the skill with which it is cultivated, and that nowhere in the wide world are the homes of the yeomanry more replete with the comforts and even luxuries of life. Good as is the general character of the agriculture of the county, there is still a wide margin for improvement, and we venture to make a few suggestions in order to elevate the standard of farm management.

Like the old divines we will commence with the negative, and say that a *large* farm is not necessarily a good one. We are not aware of any prejudice against large farms. Much has been said lately in favor of small estates, and books have been written entitled "My Farm of Ten Acres" and "Four Acres Enough," and quite lately one with the ridiculous title, "My Farm of Fourteen Rods." This may not be "running farming into the ground," but it is running it somewhere out of sight. Whether a man should cultivate a large or a small farm must depend upon circumstances; his capital, the branch of farming he pursues, his capacity to handle a large number of workmen, etc., but it cannot be denied that the tendency of most farmers is to spread themselves over too great a surface. It sounds big to say we own a thousand acres, but if we have to skim over

this great extent to secure what might be garnered from a tithe of it, the profit and pleasure must be far less. The social privileges are also greater where the cultivation is so perfect, that a dense population can be sustained. Our Southern friends could have few churches and no system of common schools, because their plantations were too large. The farms in Berkshire County, vary from ten to twelve hundred acres, will probably average one hundred, and if the average was reduced to fifty, twice as many families could be supported; and it is men and women, not land and cattle, that give value to a place.

Again, good land does not necessarily imply good farm management. The Great Creator distributed fertility among lands, much as he did talents among men, and the perfection of farm management is to make the soil produce all that, and just that it is capable of producing, as the perfection of education consists in developing all the faculties of the mind. The old saying is, "You can't make a whistle out of a pig's tail," and in like manner we cannot make vineyards nor grain farms out of some of our mountain lands, but grass can be made to grow where grain will not, and he that makes the most out of a grazing farm, deserves credit equally with him who cultivates the alluvial meadow. We have the authority of Dr. Seelye for saying that a whistle has been made from a pig's tail, but whoever makes one, pays dear for his whistle, and there are lands which do not pay for cultivation, and in such cases we should consider it good management to let them revert to forest.

Neither does the hoarding of money from the products of the soil necessarily involve good farming. Money is a good thing, but manhood is better, and he that skims his farm and keeps his family on skim milk, that he may lay up money for heirs he knows not whom, or that he may be considered rich, is not a good farmer, but he is simply a poor, rich, fool. A great mistake with many farmers, is not to invest on their farms their surplus earnings. The manufacturer grows rich by improving his machinery and extending his business, and the farmer should grow rich by the increased value, and sometimes by the increased extent of his land. At all events, this world was never made for a great savings bank, and making money is not the great test of success in agriculture. Columella, a distinguished agriculturist among the old Romans, gave his countrymen this sage advice,

applicable to Yankees as well as Romans, " Whoever would devote himself to the pursuits of agriculture must cultivate the faculty of spending."

This leads us to say, as our final negative, that good farming requires liberal, but not extravagant expenditure. The man who lives upon the productions of his land cannot lavish money upon it, as he who makes his farm a mere plaything. The city gentleman and the country gentleman, can learn much from each other, but the country-seat must not furnish the model for the farm. We welcome the denizens of our crowded cities, to our pure air and beautiful scenery, and are much obliged to them for crowning our hills with their mansions, introducing much good stock, giving us specimens of landscape gardening, and setting us an example of the amenities of city life, but as the tailor cuts his coat according to his cloth, so must the farmer expend according to his means. There is a golden mean between parsimony and extravagance. Nature deals bountifully with those who deal bountifully with her, and farmers can well afford to spend liberally for fertilizers, good buildings, good tools, and good stock, but not one cent for snobbish display.

But we must hasten to some of the positive points in good husbandry; and the first is: there must be some well devised and thoroughly prosecuted system. Agriculture, like every other art, has many divisions and sub-divisions, and he is a good farm manager, who selects some division to which his soil and capacity are adapted and pursues it with unfaltering faith and systematic energy. If the dairy branch of farming is selected, then dairy it should be, and the dairy business should be studied with all the light the experience of other dairymen in this and other countries, in this and other ages, can throw upon it. He that gropes his way by his own experience solely, must creep when he might just as well walk. Experience is the best schoolmaster, but it does not follow that we cannot learn from the accumulated experience of our cotemporaries, and all who have gone before us, as well as from our own limited observation. No matter what branch of farming is selected, it must be studied thoroughly and pursued perseveringly and systematically, or eminence cannot be attained in it. Changing from the dairy to wool, and from wool to stock breeding, with every changing current in business affairs, is most certain to end in partial success, if not in

complete failure; but show us the farmer who has pursued through life one steady course with intelligence and industry, and we will show you one whose efforts have been crowned with great success.

In the second place, the progressive farmer is the good manager. All men are naturally inclined to get into the ruts, to do as their fathers did, to take life easily and jog along this year pretty much as they did last, and we are sorry to add this is particularly true in an agricultural community; such a course never leads to excellence. The world moves, and if we would keep up with it, we must move. The fogy who rejects improved machinery and improved modes of culture, mows with a scythe, and denies the virtues of compost, must expect to see himself distanced by his neighbors, who are awake to the progress of the times. The farmer who wastes his corn on porcupine hogs and his hay on raw-boned cattle, may blame Providence because he does not succeed as well as his neighbor who feeds Suffolks and Durhams, but the trouble with laggards is in themselves, not in Providence. We have met with those who really thought the world moves in a circle, that history repeats itself, that a Beurré d'Anjou pear is no better fruit than graced the tables of our grandfathers, and that a Durham ox has no more symmetry of form than the ox which the old Egyptians worshipped. To all such we can only say, "Ephraim is joined to his idols, let him alone." In a well managed farm we want to see the land, the stock, the implements, the products and the buildings improving from year to year. The farmer of high aspirations can never be content to move on a dead level. His energies are not satisfied unless he is pushing up an ascending grade.

Again, we say that good farm management demands some taste as well as energy and skill. Taste is that faculty that discovers beauty, order, proportion, symmetry and fitness in things, and finds scope for its exercise on the farm, just as well as in the milliner's shop or dry goods store. We know there are some farmers who discard all idea of beauty and make utility the great end of life. Such place their cabbage patch in the front yard, and their pig-pen in close contiguity to the kitchen door, cannot afford their wives a plot of land for flowers, and think shade-trees cumberers of the ground, build a story and a half house, and locate the barn so as to obstruct the best prospect, pile refuse lumber by the side of the road, and old sleds and

cart wheels by the side of the house. All this may be convenient, but is entirely inconsistent with the idea of symmetry and order which the Creator has implanted in all men, and the cultivation of which adds comfort and charm to life. As soon as we put our eyes on the premises of a farmer, we know whether he is blessed with a cultivated taste or not, and we should be forever ashamed, if we awarded a premium to a man for a well managed farm, whose premises indicated great neglect of this faculty. When God made the world, he did not design it with sole reference to utility. There is beauty in every object in nature, and we do but carry out the plan of the Creator, when we arrange our buildings with an eye to symmetry, and make our home attractive. If there is any heaven on earth it is in the home, and it should have an air of comfort, so that the family may be attracted to it as "a thing of beauty and a joy forever." It is the absence of taste in some farmers' premises, that has driven the children to seek a more congenial home elsewhere.

But we must hasten, in conclusion, to say that on a well managed farm, intelligence so guides labor that every dollar spent tells to the greatest advantage. "The mind is the standard of the man," and the intelligence displayed on the farm is the standard of its excellence. It is a great mistake to suppose that muscle is the great motive-power in agricultural pursuits, and that the bright son must be sent to college, and the dull boy to the plough. Nowhere is intelligence more in demand than on the farm. In draining, composting, stock raising, and indeed in every branch of farming, much money has been wasted for the want of knowledge. Take for example the simple matter of fencing. Many of our farms are cut up into small lots, by fences which have cost as much as the farms are worth. Pastures have been divided and sub-divided, under the influence of the old but false maxim, "A change of pastures makes fat calves." A better version of the maxim is, "A change of pastures demoralizes cattle." It certainly necessitates a great and useless outlay for fences. Money is not coined so easily in farming that we can afford to spend it for that which profiteth not. Intelligence must guide every step the farmer makes. If a Durham steer at two years, weighs as much and is worth as much as a native at three or four, then it is foolish to raise natives in preference to Durhams. If a good garden will half support a family, and add

greatly to its health and comfort, then a little time and money spent in the garden are well invested. If a cellar furnishes a solid foundation for the barn, and warm and convenient room for stabling and storage without any additional shingles, then the intelligent farm manager will be sure to have a barn cellar.

ALEXANDER HYDE, *Chairman.*

PLYMOUTH.

From the Supervisor's Report.

Increased production may be secured at a ruinous loss to the productive capacity of the soil, as is painfully apparent in the condition of numerous farms, once fertile and fruitful, but now exhausted and almost sterile; once teeming with busy life, but now almost or entirely deserted. Such impoverishment of the soil is not peculiar to Massachusetts or even to New England. The same process is in continual operation in other parts of the country, although the same result may not be so speedily reached in the more fertile soils of the so-called producing States as it has been in Massachusetts.

To prevent as far as possible the repetition in the future of the process of deterioration, and to remedy as far as practicable the evil consequences of its prevalence in the past, is the appropriate office of agricultural societies. They aim also at "increased production," with this very significant qualification, "from diminished areas." One of the agencies employed by them for this purpose is the offer of premiums for field crops, to be awarded mainly upon the basis of comparative quantities per acre; and this basis of awards, however much it may be objected to by men claiming for themselves peculiar shrewdness, is the most satisfactory in its results, considering both the crops and the condition of the land, of any yet devised. From the evils consequent on the cultivation of land which has been, and is growing year by year less productive, the cultivator of premium crops is sure of exemption. The conditions essential to his success, are liberal and judicious applications of plant-food and frequent and thorough cultivation; and these conditions fulfilled, the results must inevitably be generous returns, in the form of present harvests, and increased capacity of the soil for future production.

Judgment in the application of manures is quite as essential as liberality. Bread is said to be the staff of life; but perfection of physical growth in man cannot be secured by the exclusive use of bread, even the best; nor perfection of vegetable growth by the application to the soil of ammonia only, or phosphate of lime, or any other one of the organic or inorganic substances that jointly contribute to the formation of healthy and vigorous plants. Manure from well-fed animals, in sufficient quantities, more nearly compensates for the loss of the productive elements in soils, consequent on repeated cropping, than any other single attainable fertilizer. But even this will fail to maintain perpetual fertility through its deficiency in mineral substances. If this is true of manure from such animals, what shall be said of that from the ill-fed and poorly housed stock, once so common, and even now seen occasionally, hovering about the sheltered sides of buildings and fences, or reluctantly pursuing the scattered wisps of coarse fodder, whirled by the wind from the corner where it may have been thrown for their morning or noonday meal. If any portion of the manure made under such circumstances fails of being blown away or washed away, its effect upon the soil to which it is applied will be very similar to that of the food from which it is made upon the animals compelled to consume it. Time was when the possession of large areas in the marshes on our coast and in the natural meadows on our streams was considered by all farmers, whether of large or small means, indispensable to the keeping of neat stock; and such marshes and meadows now in many cases deemed worthless were for many years held, or sold at prices which by the present generation would be thought almost fabulous. Salt and fresh hay are as nutritious now as forty years ago, but, fortunately for our dumb animals, such hay is seldom relied upon for their subsistence to any considerable extent. There are farmers—and very good farmers, too—who continue to make their annual midnight pilgrimage "down to the salt meadows," always deeming an apology necessary for so doing, and always finding one in the belief that their cattle "eat better" for being sometimes fed on salt or fresh hay, a belief which is undoubtedly well founded, as nothing is so well calculated to sharpen the appetite of man or beast as an occasional meal of innutritious food. Against this hygienic view of the subject,

nothing, perhaps, can be well urged. But stock fed on early-cut and well-cured English hay, such as is wont to follow premium crops of roots or cereals, seldom needs special treatment for promoting an appetite ; and in the fact that so large a proportion of the stock in the State is fed on such hay, and on grain and roots, is to be found one cause of the improving condition of some of the land used for agricultural purposes, and of the increase of agricultural products, notwithstanding the constant decrease in the number of acres of what the valuation committee would denote as "improved land." Well-fed stock and well-manured land act reciprocally, as cause and effect, each affecting the other, and being in turn affected by it.

It is not uncommon to hear agriculturists of a certain class spoken of as "fancy farmers," the term being applied to those who devote only their money to agricultural operations, in contradistinction from those who depend mainly upon their own personal labor for success, and who are termed practical farmers. But the time may come when we, who are compelled to "farm it" without capital, may recognize the so-called fancy farmers as the salt of the earth, in their influence upon its agriculture. From their theories, many of them absurd and chimerical, from their experiments, many of them ill-conducted and unsatisfactory, and from their earnest discussion of topics once supposed to have very little if any connection with practical farming, has proceeded, in great measure, the admitted advancement in agriculture as a science, followed by a partial awakening of the community to the necessity of popularizing agricultural industry, as lying at the foundation of national prosperity. Through their efforts knowledge has been increased and disseminated, and the most practical of farmers have been led to make great changes in the methods and appliances of their vocation. But, aside from the indirect influence which the class of whom we are speaking exert upon the opinions and practices of the mass of farmers, their opinions are in themselves directly and eminently practical. The fact is patent to all observers, that, on very many farms, not only are permanent improvements wholly neglected, but that even the conservatism, which would, at least, keep things as they are, is very far from being generally apparent ; that mowing lands are given over to pasturage, and pastures suffered to grow to wood and bushes ;

and that the general aspect of many portions of the country would warrant the impression that farming is, to use a homely expression, on its last legs. If, then, while so-called practical farmers permit their farms to deteriorate year by year, and to return slowly but surely to their originally uncultivated condition, there are men, not "to the manor born," who are willing to expend their surplus wealth in reclaiming and rendering fruitful farms previously neglected and unproductive, in transporting fertilizers, ammoniacal and mineral, scores, perhaps hundreds of miles, and in other ways promoting the production, in constantly increasing quantities, of grains, roots and grasses, as food for man and beast, who will say that the result is not a practical one, or that the community is not greatly in their debt, especially when comparing their course with that of others, who use their money only to insure greater accumulation, or expend it in personal gratifications or upon the mere fripperies of fashionable adornment.

The truth is, agriculture is following, though at a somewhat tardy pace, the course of all other active vocations, and its successful prosecution in the future will require, and, in a constantly increasing ratio, will receive, all the aid which science can supply or capital command. It is not meant by this that the possession of capital by each individual farmer will be absolutely essential to his success, but that capitalists will more frequently become farmers; and that their capital, operating with and through the highest knowledge and best skill attainable, which money can always command, will test theories and establish practices, which, when so tested and established, can but be accepted and adopted by all farmers in whom self-conceit is not predominant over self-interest.

Farmers have heretofore obtained knowledge principally through their own experience, a most excellent schoolmaster, as all must admit; but the process is a tedious one, especially as it must be repeated by every seeker after agricultural wisdom. Hereafter they may find it advisable to avail themselves more generally of the experience and observation of others, either by accepting their personal instruction or by studying the recorded results of their operations.

ALDEN S. BRADFORD, *Supervisor.*

IMPROVEMENT OF MEADOW AND SWAMP LANDS.

MIDDLESEX SOUTH.

Statement of Isaac V. Adams.

The piece of improved meadow which I enter for premium is situated in Little Cedar Swamp, in the east part of the town of Hopkinton. As the improvements which have recently been made upon this tract of swamp land have been fully described in previous reports I will not repeat them here.

This lot is fifty-eight rods long from east to west, seven rods wide at the east end, and five rods at the west end. As it is bounded at each end by the main channel, excavated by the Commissioners, (see Agriculture of Mass., 1865–6, page 35 of the Abstract,) it was only necessary to cut a cross ditch on each side connecting at each end with the main channel.

In order to facilitate getting on to the lot, and to avoid the expense of a bridge, the ditch was omitted on the south side for about four rods near the middle, and as the water passes readily from this point, both east and west, to the main channel, the drainage is as perfect as though the two parts of the ditch were connected.

These cross ditches were cut in July, 1864, at a cost of thirty-three and one-third cents per rod by contract. They are three feet wide at the top, two feet wide at the bottom, and about three feet deep. As these cross ditches are equally advantageous to the adjoining lands, only one-half the expense should be charged to this experiment.

By the latter part of July the part of the lot on the east side had become sufficiently dry to burn. I accordingly set fire to it and got a most excellent burn. The sod was all consumed and the ground left light and fine, nearly a spade deep. I sowed a half peck of herdsgrass seed, and a peck of redtop, and harrowed it in. The remaining portion was not dry enough to burn until the last of August, at which time I set it on fire but obtained only an indifferent burn. The grass roots were not near all destroyed, and I was obliged to enter the lot with cutter, and puller, and plough, and spend considerable time in tearing up the tough

places and getting all the sods loosened so that they might dry and be consumed at the second burning, which was successfully accomplished a few weeks later. I did not, however, seed down this part of the lot until the autumn of 1865, when I sowed one peck of herdsgrass and one-half bushel of redtop. The portion first alluded to gave a good crop of English hay in 1865, and the entire lot a good first crop and a fair crop of rowen in 1866, and one fair crop in 1867.

In the winter of 1867 to 1868 I covered the entire surface of the lot with gravel, applying twenty loads, of twenty-five bushels each, to the acre. This application of gravel improved both the quantity and quality of hay, of which there was a good yield—say two tons to the acre—in 1868.

In the winter of 1868 to 1869 I applied twelve loads to the acre (twenty-five bushels to a load) of compost, composed of three parts sand and one part night soil, which is obtained at the village three miles distant, and composted in a sand bank lying conveniently by the side of the meadow and in sight from this land.

The condition of this ground previous to the commencement of these improvements was like that of the entire swamp, wet, cold and unproductive, too soft to admit of driving a team over it. It is now so hard that the hay is cut and raked with horses, no field in the county being better adapted to the use of machinery than the level, unobstructed breadths of these meadows. Wonderful, indeed, are the results of well directed LABOR.

To intelligent labor how applicable are the words of the prophet Isaiah, when he says: "He will make her wilderness like Eden, and her desert like the garden of the Lord."

EXPENSES.

Interest and taxes, ...	$10 00
Burning three times, ...	7 00
10 days ploughing, cutting sods, etc., ...	15 00
$1\frac{1}{2}$ pecks herdsgrass seed, ...	1 50
1 bushel redtop, ...	1 00
Sowing, ...	50
50 loads gravel, at 20 cents, ...	10 00
12 loads manure, ...	12 00

Applying manure, ...	$2 40
112 rods ditch, (one-half expense,)	18 67
Total expense, ...	$78 07

PER CONTRA.

12 tons of hay raised since 1864, valued, *standing*, at $13, ...	$156 00
Increased value of land, ...	180 00
Total, ...	$336 00

HOPKINTON, August 1, 1869.

MANURES.

ESSEX.

From the Report of the Committee.

The Committee on Manures have received but one invitation from the farmers of Essex to examine the progress and results of experiments with manures or commercial fertilizers. The farm of Wm. R. Putnam, of Danvers, was visited by his request in September, and some crops upon which he had applied various kinds of fertilizers were examined. Mr. Putnam has handed us a report of these experiments, which we herewith transmit for publication. Mr. P. deserves commendation for his zeal and painstaking in procuring and applying to his crops some of the well-known compounds called fertilizers. In examining the crops to which they had been applied, but little new information was obtained, and but few useful facts were deducible. In fact, what can be learned from the experiment of seeking, in the market, a mixture called "Croasdale superphosphate," or "Baugh's raw bones," or any other "raw bone" compounds, and applying them to a few rows in a corn-field or potato-patch? In the first place, who knows what the raw bone mixtures or "superphosphates" are made of? Certainly the experimenter does not. It is apparent, then, that the experiments must be

empirical, inasmuch as the substances experimented with are of unknown fertilizing value. The "phosphates" or bone mixtures usually possess no uniformity in composition. One farmer may be lucky enough to secure a barrel or two of the substances in which a considerable amount of plant-nutriment is found; another may purchase packages of the same brand which are almost wholly destitute of the phosphatic or nitrogenous elements, and are therefore practically valueless. These, employed in the usual empirical way, of course give varying results—results which are better calculated to confuse and perplex than to instruct.

But if the fertilizers we employ are honest mixtures, and have a fixed value, how much positive practical information can we gain from applying them in a small way, in our fields, without taking into account some important considerations which are usually overlooked? It is true, if we thrust the "raw bone" into the hills of one row of potatoes, and leave the next one without the mixture, we can measure and weigh at harvest time, and thus obtain results from which to form wise conclusions or dogmatic opinions. These results, however, must be regarded as blind guides. Any experiments in husbandry which do not extend over a period of time exceeding one or two seasons, and which do not take into account variations in soils and meteorological conditions, are practically worthless. It appears to your Committee high time that the intelligent farmers of Essex abandoned the "irregular," uncertain, empirical methods of experimenting with fertilizers, and adopted a form better calculated to advance true knowledge in respect to the greatest interests of agriculture. In the first place, the materials experimented with should be definitely understood. In phosphates, the exact percentage of soluble phosphates of lime contained in the fertilizer should be known, and also the amount of free ammonia, or ammonia-forming constituents. If substances containing potash or soda are employed, a knowledge of the exact percentage of these alkalies also should be had. With the best and most appropriate materials in our hands, we do not obtain in one or two seasons even a proximate knowledge of how much actual value they may be to our crops. A dry season may prove entirely unfavorable for the appropriation by plants of any one element or compound, or a wet

season may produce like results. If a farmer should judge of the influence of a phosphate upon his corn in a dry season, he might be led to condemn one year a material which in the next would prove his most efficient and prompt friend. When we bury in our soils a fertilizing agent, it is quite uncertain when we shall receive back the value or thrice the value in increase of crops. If we are *sure* we have got the genuine agent there, and in an assimilable condition, we need have but little solicitude concerning ultimate good results. Five years is short time enough to conduct experiments with fertilizers to reach ends, or obtain results worth publishing to the world. Much of the confusion existing among soil cultivators regarding the value of fertilizing agents arises from the incomplete, unfair, unscientific "trials" or experiments made. The public taste is so perverted, that all statements of this nature given in the agricultural papers are read with a peculiar relish. If a farmer is anxious to see his name in print, let him buy a peck of "raw bone phosphate," or "patent guano," sprinkle it in a few hills of corn, or in the turnip drills, and in the autumn send the "results" to the nearest journal. The fame, although short-lived, will be cheaply bought. With the care, accuracy and completeness of detail demanded of experimenters in every branch of science, in this age of the world, it is a pity that we should not improve our methods in all departments of husbandry. Before scientific agriculture can rise to a point worthy to command confidence and respect, this must be done.

In behalf of the Committee.

JAMES R. NICHOLS.

Statement of Wm. R. Putnam.

It is with some reluctance that I make public my experiments with manures. I regret that my crops were not seen by the Committee earlier in the season; coming as you did, just after the severe gale, you had not so good an opportunity to judge of the effects of different kinds of manure as you would have had before the gale.

If I rightly understand the object of the society, in offering this premium, it is to collect and publish such information upon

the use and the effects of different kinds of manure as will enable the farmers of the county to judge better what kinds of manure to use. If in my statements I can furnish a peg for you to hang your report on, I shall be satisfied.

Early in April last, when planting pease, part of the piece was manured with good manure made by the horses, cows and sheep, applied at the rate of six cords to the acre ; to the remainder I applied Croasdale's superphosphate, at the rate of four hundred pounds to the acre. This costs about three cents per pound, and it is said that it is one-third Peruvian guano, and the remainder mostly mineral phosphate from South Carolina. The pease were as early and produced as well as those that were planted upon the manure.

Some of the farmers in this vicinity have been using pine sawdust from the saw-mills for bedding for their stock. Does it injure the manure, is a question that I should like to see settled by a course of well-conducted experiments. Last February I spread about ten bushels of sawdust, that had been partially dried, on the floor of my sheep-pen, then covered it well with hay, so that the manure would not mix with it ; the sheep were kept upon it till the last of April, when it was well saturated with urine ; this was mixed with some sawdust that had been used in the stable, and well wet with the urine from the horses. I planted pease upon it ; they came up, but did not grow much. By digging and examining them, I found the rootlets avoided the sawdust, and got their nourishment from the soil beyond it.

The first week in May I planted a field of potatoes ; part of it being manured at the rate of six cords of manure to the acre, which was a compost made by mixing three cords of barn cellar manure with three cords of meadow muck. This was put in the drills on part of the field, and by the side of it I applied Croasdale's Superphosphate at the rate of four hundred pounds per acre. The same kind of seed was used, (the sebec) those on the manure yielding at the rate of 256 bushels to the acre, and the phosphate giving at the rate of one hundred and twenty-two and one-half bushels per acre. Those on the phosphate came up first, and were of a deep green color in June ; in July they rusted. On one acre of the same field I spread six cords of manure, of the same kind as the other, and harrowed it in. It was then marked out in drills, three feet eight inches apart,

and planted with Harrison potatoes. On twenty-four rows I put one hundred pounds of Peruvian Guano, costing five cents per pound; two rows were left without additional fertilizers; the next twenty-four rows had one hundred and fifty pounds of Croasdale phosphate, costing three cents per pound. The acre yielded three hundred and fifty bushels. In the first part of the season, when the guano was applied, the vines were much the larger, and I thought before I dug them that the guano would increase the crop twenty-five per cent., but when they were harvested, I had as many bushels of marketable potatoes in the two rows that were left without it, as in the others. They were uniform in size, though not near so many in number. By measurement, I find that one hundred pounds of guano gave me five bushels of small potatoes and a great heap of vines, the phosphate gave three bushels of small potatoes and about half as much increase of vines as the guano.

In the corn-field which you saw, I applied different kinds of manure, but it was so much injured by the wire worms in the first part of the season, that I cannot give any accurate statement. But the guano, and the phosphate gave only about half as much corn as the stable manure. That on the fish guano, where it was not injured by the worms, did well.

The manure on the field of ruta-baga turnips, which you saw, was prepared as follows: To three cords of meadow muck, I added one cask of lime, twenty bushels of ashes and four hundred pounds of ground bones. In the first four rows we used the mixture at the rate of six cords to the acre. The first row yielded twenty-two bushels, the next seventeen bushels. I account for this difference by the fact that the first got some benefit from the manure upon the cucumbers that were planted by the side. On the fifth row we put two-thirds of the quantity of this mixture, and added twenty pounds of Fales' fertilizer, costing three cents per pound. This produced seventeen bushels. On part of the field, a compost made of barn cellar manure and meadow muck was applied at the rate of four cords per acre, and twenty pounds of Baugh's raw bone (this bone is prepared at Chicago and costs three cents per pound). Where this bone was added to the compost, the turnips were the best in the field; twenty pounds of this bone produced one hundred and fifty

pounds of turnips. On this piece, containing about two-thirds of an acre, we had three hundred and thirty-seven bushels.

If I had not already made this statement too long, I might speak of the effects of different kinds of manure upon the squash crop and the cabbage.

ORCHARDS AND VINEYARDS.

MIDDLESEX.

From the Report of the Committee.

There are few subjects connected with the agricultural industry of the county of Middlesex of more vital importance than those under consideration, viz., its orchards, vineyards and gardens.

At present, its orchards—apple, peach and cherry—have, in a great measure, lost their past fruitfulness, and give no high promise for the future. Pear orchards are more promising, although blight and disease have found their way into them; and unless some new developments in science or art are found to aid the cultivator in arresting their progress, may yet destroy their fertility, as they have of the apple, peach and cherry. It is hoped that men of science may yet discover a remedy sufficiently cheap and practical to avert so great a loss.

With regard to vineyards, the Committee find much gratification in observing that a fruit is now extensively cultivated which is adapted to light, warm lands, of easy cultivation, and not among our best lands for the production of the grasses or the cereal grains.

If the reader will refer to the statement of Mr. Moore, which is subjoined, he will find described such a soil as we refer to, and which is yielding the grape in the most luxuriant profusion, and, according to his statement, without the aid of high manuring. Indeed, he considers high manuring pernicious rather than useful. The land upon which Mr. Wheeler's vineyard is set is of a similar character. Both are what are termed sandy loams, though we should judge that there is a higher percent-

age of sand in Mr. Moore's soil than in that of Mr. Wheeler. Here, then, we are able to produce a hardy and healthful fruit in abundance, on lands, most of which have been considered as second-rate in value. From the earliest settlements, they have been devoted to a few annual crops of rye, left to be recuperated by nature's processes, and then cultivated to rye again, until nearly all their vegetable powers were exhausted.

But with the care bestowed by the gentlemen now competing for a premium, the grape will grow on almost any soil and in any position—in the corner of the yard or by the side of the porch. It may be trained on the roof of the woodshed, on the side of the barn, on a simple trellis, or on a simple stake. The sunny corner of the garden, which would not be convenient for a tree, will afford space and shelter for a vine. Even cities and villages have many places that the grape-vine likes the best. Placed in the front or back yard of the dwelling, its roots find their way under walls and into places where they can select the precise nutriment they require. There they find shelter from rough winds, and protection from early frosts, by the warmth radiated from brick or wooden walls or fences. In this way some of the most perfect samples of the grape are grown. The vines grow to a very large size, and produce fruit in proportion. One plant in the famous Hampton Court vinery bore *two thousand and two hundred bunches*, averaging one pound each, making more than a ton in a single season. Another vine at Valentines, in Essex County, England, produced *two thousand bunches*, of nearly the same weight, at a single crop. The branches of the vine at Hampton Court covered a space of three hundred and forty-eight square feet, and that at Valentines four hundred and forty-one square feet. Under favorable circumstances they attain a great age. Some have died known to be more than a hundred years old.

There is, then, this encouragement in planting grape-vines: that they produce their fruit in one or two years after setting, and hand it down in perfection through several generations. It is hardy, easy of cultivation, palatable and nutritious as food, and, in several forms, exceedingly grateful to the sick.

A single entry only was made for a premium on "Fruit and Vegetable Gardens," and that by Edwin Wheeler, of Concord. The garden contains one and a half acres of land, on which

there are three hundred and seventy-six pear-trees, seventy-five grape-vines, and eight apple-trees. Among these were egg-plants, squash, melon and cucumber vines, tomatoes, and other plants useful in the culinary department of the house. In other portions of the grounds seeds for market are quite extensively cultivated, such as beet, parsnip and carrot seeds.

The small fruits were also grown, such as strawberries, raspberries, currants and blackberries.

The soil is a deep, black or sandy loam, but the vegetable matter is largely prevailing. All the crops were free from weeds, and the soil everywhere in a high state of pulverization. The grape-vines and apple-trees are set on the west and north sides of the garden, and Norway spruces on the east and south borders, all acting as screens, and consequently modifying the climate considerably.

The arrangement of the trees, grape-vines and all the smaller plants gave evidence at once to the Committee that the garden was under the control of a skilful and neat workman. All the rows were in straight lines, and bore the marks of constant and careful attention. The soil was mellow and rich, deep, porous and moist, so that the growth was vigorous and the product abundant.

The pear-trees made up a portion of the garden, and may well claim some attention here. Most of them fruited the present season, and were the source of considerable profit. The cultivation of this delicious fruit has now become general in all gardens which are worthy of the name. The number of varieties used by the common cultivator is altogether too large, as Mr. Wheeler suggests. The extension of varieties, and ascertaining those of greater value, may well be left to persons of large study and experience on the subject, or to amateurs, who can afford the losses which must always occur in testing varieties. So much, however, is accessible to all in regard to the hardiest, richest and most profitable varieties, that the Committee do not consider it expedient to enter into any statement of that nature here. They recommend to all, however, who are about to engage in pear culture, to visit the orchards of those who have been successful, and learn the modes of culture which have resulted profitably.

No entire apple orchard was entered for premium.

The Committee examined, with much pleasure, a *peach orchard of three hundred trees*, entered for exhibition only, by John B. Moore, of Concord. The trees have been set two years, and are three years from the bud. The foliage on them was large and high-colored, the trees symmetrical in form, and had every appearance of health and vigor. They stand on a sandy loam, like that upon which his grape-vines are set.

As the value of this Report will chiefly consist in the statements made by the competitors, the Committee refer the reader to them for full and clear descriptions of their modes of culture, and the results which they bring.

JOHN CUMMINGS, *Chairman.*

Statement of John B. Moore.

In offering my vineyards for the Society's premium I desire to call attention more particularly to the lot directly back and north of my house. Aspect, a very slight inclination to the south ; soil, light sandy loam, underlaid with a hard red gravel, full of cobble-stones. In the year 1864 the wood was cut from this land, which had formerly been used as a rye field for many years, and was composed of a small growth of pitch-pine, white birch, and scrub oak. After the wood was removed the land would not have sold for more than $15.00 an acre.

The brush was burned and the lot ploughed as well as possible where full of scrub oak roots and stumps, and then planted for two years, principally with melons and squashes, and manured in the hill only.

In the spring of 1867 I planted on this lot five hundred Concord grape-vines, one year old from the cutting, which have been trained on large stakes ; also two hundred more of the Concords, and two hundred Hartford Prolific vines, which have been trained on a wire trellis. The Hartford Prolific vines were nearly ruined by the last two severe winters ; although laid down and covered with soil, the tops came out all right in the spring, but the roots were mostly killed or injured by the severe freezing. I shall be obliged to remove most of them and plant Concords in their places.

When these vines were planted, in the spring of 1867, there had not been any manure applied to the soil, except the manure in the hills for melons and squashes, before mentioned, and

which is the only manure that has been used on this lot up to the present time, except what I shall mention hereafter, in connection with the strawberries raised between the rows of vines.

At the time of planting the vines the ground was ploughed, harrowed, and made as fine and level as the remaining stumps and roots would allow, and then carefully planted in straight rows, ten feet apart, and seven from each other in the rows, where stakes were to be used to support the vines; between the rows I planted two rows of strawberries, which were allowed to run into beds. In the spring of 1868 the edges of these beds were trimmed, which left two beds three feet wide, with a path on each side of them; from these beds I sold, in 1868, a little over $400.00 worth of berries and plants, and the only manure or fertilizer that was applied to them was a lot of ashes from a pile of stumps, gathered from the same lot, burnt, and spread where the strawberries were to be planted, and two hundred pounds of superphosphate of lime sowed in the spring of 1868. In July of the same year, as soon as the crop of strawberries was gathered, the entire beds were ploughed under. Since that time there has been no crop raised between the vines.

These vines have certainly been grown without animal manure, and I might say, almost without any manure; still, I would not have it understood that I would not use any manure, for I certainly should, if in my judgment the vines needed it. What the grape-grower must have to produce the best crops of fruits, is a medium-sized short-jointed, solid and well-ripened wood; excessive manuring does not give that, but rather a coarse, long-jointed, immaturely ripened, soft, spongy wood; the first will produce an abundance of fruit, of good quality; the last, less fruit and later in ripening; perhaps, I should say that withholding manure would apply more particularly to the strong-growing varieties, such as the Concord, Hartford, Diana, and most of the Rogers'.

Five hundred of these vines are trained on stakes, two arms and two stakes to each vine; one arm is coiled around each stake, and spur-pruned with rather long spurs, as the two buds nearest the old wood are very often only leaf buds, and would not give fruit. This is the case with the Concord, more particularly than with other sorts. The rest of the vines are on a wire trellis, and are intended to spread out as evenly as possible

over the trellis; in pruning I cut out a large portion of the old wood every year and lay in new canes in its place. From these vines there were gathered one hundred boxes, of forty or more pounds each, or two tons of grapes, which were sold in Boston as soon as gathered, at from twelve to thirteen cents a pound, in bushel boxes, without any particular packing.

I regard the grape as more certain to produce a crop than any other fruit we grow. During the last ten years there have been only two seasons in which the crop has not matured very well under good cultivation, and those (1867 and 1868) were only partial failures. Even in 1868, I averaged as high prices as the present year, although the fruit was not nearly as good in quality. Can that be said of any other fruit? It does not require much, if any manure, which is so much needed for the other crops on the farm; and to be a success it only requires ordinary skill in selecting the soil, and planting good, strong, healthy vines, of some well-tried variety, like the Concord, which is the only kind I have found profitable. I have about exhausted the nurserymen's catalogues, and have been disappointed with many new kinds, coming highly recommended and costing high prices.

A wire trellis, with good posts, well set, and three strands of the best galvanized wire, No. 13, costs about $3.50 for one hundred feet in length; the same length, with stakes, would cost according to the size of the stakes; if they cost three cents each, with setting, it would be $1.12 for one hundred feet; if seven cents each, for very large ones, $2.24 for one hundred feet; it requires much more time and labor to prune, tie, and take care of vines on a trellis than on stakes. Which will produce the most, or best fruit in the end, is the question to be solved. I have only tried a trellis five years; so far, one is as good as the other, as far as cropping is concerned, with, as I have said before, a great difference in favor of the stakes in the amount of tying, pruning, and care.

I have also entered my peach orchard, of three hundred trees, which is on the same sort of soil, and adjoining the lot containing the grape-vines, *for exhibition only;* these trees have been set two years next spring, and have grown entirely to my satisfaction; if they only escape the disease called the yellows, I feel confident of getting fruit. I have entered them for exhibition only, thinking that no orchard should receive a premium

until it has shown its capacity of producing abundant crops of good fruit.

Respectfully yours,

JOHN B. MOORE.

Statement of Edwin Wheeler.

Wishing to compete for your premium "for the best vineyard of not less than one-half acre, which shall have been set or planted since the year 1863, and which shall be in the best and most productive state in the year 1869," I herewith present the following report:

The piece contains about one acre of good plain land, or corn ground, underlaid with sand and gravel, and is situated on the east bank, and within ten rods of the Sudbury River, lying from fifteen to twenty-five feet higher than the ordinary level of the water, sloping gently to the north and east. It had been used as a pasture for six or eight years previous to 1864, when it was ploughed about ten inches deep, and manured with about twenty-five horse-cart loads of compost manure per acre, and planted with potatoes. In 1865 it was ploughed, manured the same as the year previous, and planted with corn.

In the fall of 1865 and spring of 1866 I planted about two-thirds of the piece with Concord grape-vines, which I grew from cuttings the previous summer. They were set in rows eight and ten feet apart, alternately, for the purpose of better passing between the rows with the team, the rows averaging nine feet apart, the vines seven feet in the rows. The ground between the rows, for two years, was planted with early potatoes, white beans, and for setting carrots and parsnips, for seeds (manuring them lightly in the drill), thereby receiving a paying crop from the ground, while the vines were unproductive. The third year I set between the rows yearling vines, a part of which you saw when you examined the vineyard.

The first year after planting the vines, only one cane was allowed to grow; these were trained to small poles, and the laterals pinched off at the second leaf; in the fall the canes were cut back to two buds; and the second year two canes or arms were grown and trained to poles, and the laterals pinched off as the year before; these, in the fall or early winter, were cut back, leaving the canes or arms from two to five feet long,

according to the strength of the vines for fruiting the following season, and were allowed to lie on the ground through the winter. In the spring of 1868 these vines were partly trained to trellises made of old telegraph wire, nailed to cedar posts, set about twelve feet apart, three or four lines of wire on each row of posts, the posts from 5 to 6½ feet above ground; the balance of the vines were wound around cedar posts 6½ feet long, two posts to each vine. This being the third year set, the vines were allowed to bear a few bunches each, according to the strength and size of the vines; the product was between $90 and $100 worth sold, which, for an unfavorable season, and the age of the vines, was a good crop. I prune in the fall, after the leaves fall, or in early winter, as I find leisure, on the spur system, leaving about two buds on each spur, which are allowed to grow the following summer to the second or third leaf beyond the last bunch of fruit, when they are pinched off; if they make large growth through the summer, I pinch two or three times. I have not applied any manure to the land since the summer of 1865 (only as above stated, for early potatoes, &c., when planted between the rows,) except fifty bushels of ashes, made from pine-wood saw-dust and shavings, under a steam boiler, which would be about one-half peck per vine.

CONCORD, Oct. 2, 1869.

Statement of Edwin Wheeler.

The fruit and vegetable garden that I offer for your inspection, contains about one and one-half acres of land, and three hundred and seventy-six pear-trees; eighty-eight are on pear stocks, the balance on quince; eighty-four were set in the spring of 1853 and 1854, by digging holes about four feet in diameter and one and one-half feet deep, using mud and compost about them. The rows are seventeen feet apart, and the trees ten feet apart in the rows, on pear and quince, alternately.

In the fall of 1863 and spring of 1864, I set eighty-four trees; they were planted at the same distance as the first lot, and on pear and quince stocks. In the spring of 1865, I planted two hundred and eight trees, all on quince stocks, arranged twelve feet by ten. I have some twenty-five varieties, which, I think, is quite to many. I prune in April or May, in pyramid form, before the leaves are fully developed, heading them in one-half

of the previous year's growth (especially the dwarfs), and pinching back some of the stronger growing branches during the summer; thereby forming stronger and better trees, which are not so easily disturbed by the wind, and the fruit is not shaken off so readily as when the branches are long and slender.

The soil is a black, heavy loam, too wet and cold for corn in ordinary seasons. In the fall of 1863, I commenced draining with two-inch tile, laying the drains thirty-four feet apart, and midway between every row of trees, and about three feet deep. The effect of this was so plainly seen the next season, that in the fall of 1864 I drained the remainder of the piece.

On the west side of the piece there are about seventy-five grape-vines, four feet apart (set within the last five years), of the following varieties, viz.: Concord, Delaware, Hartford, Creveling, Iona, Israella, Adirondac, Allen's Hybrid, Clinton, Rogers' Nos. 4 and 19, and two varieties not true to name. These are grown on a slat and wire trellis. I prune on the spur system, in November and December.

On the north end there are eight apple-trees, of about twenty years' growth, of the following varieties, viz.: Hubbardston, Moore's Sweet, Saps of Wine, Pumpkin Sweet, and Williams.

On the east side and south end are set Norway spruce, about eight feet apart. They are now about eight feet high, and were set to form a break-wind.

This piece of ground has been used since the pear-trees were set for raising all the various kinds of vines and small fruits, and as a vegetable or kitchen garden; also, for raising garden seeds of various kinds, but most extensively, beet, parsnip and carrot.

CONCORD, Oct. 1, 1869.

MIDDLESEX NORTH.

Statement of Messrs. E. Bunce and Son.

The fourth acre of vineyard which we would enter for your consideration, is situated on a side hill sloping to the west. Variety of grape, Concord, mostly strong one year old vines, from cuttings when set. Soil, generally loam. Heavy wood cleared off in 1847, burned over and sown to rye and grass.

After the rye was harvested, pastured till spring of 1865, when it was ploughed and planted with corn, manured in the hill, with a compost of hen-dung, ashes and plaster, at the rate of twenty-eight bushels of hen-dung, seven bushels of ashes, and two hundred pounds of plaster per acre, yielding a fair crop.

In May, 1866, ploughed and harrowed the ground ; then furrowed it north and south ten feet apart, east and west six feet apart, the distance at which the vines are set, setting them where the furrows crossed. Also planted a row of potatoes in the ten foot spaces, manured in the hill lightly with a mixture of flour of bone and plaster. Hoed in around the vines, at first hoeing, in 1866, forty pounds of flour of bone and six pounds of sulphur. In spring of 1866, sowed broadcast and worked into the ground forty pounds of flour of bone, with equal measure of ashes mixed, moistened with water and allowed to remain about a week before using. The vines were hoed twice in 1866, three times in 1867 and 1868, and twice in 1869, using a small horse plough lightly the first time each year, and a cultivator at other times.

The method of pruning and training has been as follows :—

In 1866, the vines were allowed to grow without pruning or training till November, when they were cut back nearly to the ground. In the spring of 1867, set stakes from two to three inches in diameter, cut eight feet long, two to each vine, one and a half feet from it, making them three feet apart in the rows, setting them about a foot and a half in the ground. As the vines grew, trained up two branches from each, one to each stake, using waste strings from the factory. In November, cut back the vines to the top of the stakes ; also pruned off any side shoots that were on them. In 1868, kept the vines tied to the stakes without pruning till November, when the branches were cut back to within three buds of the main vine.

This fall, shall cut off all of the present year's growth to within one good bud of the old wood, and so continue from year to year. Have left the vines standing winters, renewing any strings that were weak in the spring. The vines showed a little mildew in 1868, and also in 1869. Dusted them lightly with sulphur and it left immediately.

The expenses have been as follows :—

180 vines, raised by ourselves, would have sold, in 1866, for	$30 00
Setting vines, ...	3 00
360 stakes, and setting, ...	10 00
10 pounds sulphur, ...	1 00
80 pounds flour of bone, ...	2 60
10 pounds strings, ...	65
Pruning and training vines, ...	6 00
Cultivation in 1866, paid by profit on crop of potatoes, ...	–
Cultivation in 1867, ...	6 00
" in 1868, ...	6 00
" in 1869, ...	4 00
Gathering and marketing 2,375 pounds of grapes, .	23 75
Interest on value of land, ...	4 50
Total, ...	$97 50

The receipts have been :—

1868. 700 pounds of grapes sold, at 10 cts. per lb.,	$70 00
1869. 1,675 pounds sold, for 10 cents, ...	167 50
Total receipts, ...	$237 50
Total expenses, ...	97 50
Profit on the fourth acre, (to which is to be added the present value of the vines,) . . .	$140 00

WESTFORD, Mass., October 16, 1869.

HOUSATONIC.

From the Report of the Committee.

The Committee on reclaimed lands and orchards for 1867–9, having attended to their duties, respectfully submit the following Report:

We regret to say that no reclaimed land was entered for our inspection. There is an apathy on the subject of draining and cultivating the waste lands of Berkshire which is not creditable to the farmers of the county. The most careless observer, as he

passes around the county, must see that "much land remains to be possessed." The swamps that are now exhaling miasm and death should be producing sustenance for man and beast. Health and thrift alike demand this. In many instances our highways pass through these swamps, and even in a warm summer's evening, the dampness is so great that we involuntarily shudder at the chilly exposure and close our mouths that we may not inhale the seeds of consumption and typhoid fever. Whoever has any of this cold, wet land on his farm, and does not drain it, is exposing the health of himself, his family, and the community. If more drain tile were used, there would be less demand for pills and powders. Dry and pure air gives vitality, not only to man, but to the flocks and herds. Some of the first efforts at drainage in England were made by a farmer who became convinced that his sheep were suffering from disease that originated from his pastures being too wet. Both cattle and sheep, if free to select their grazing and sleeping grounds, choose the sweet herbage and pure air of the hills. Man, less mindful of the dictates of reason than the dumb beasts of their instincts, often locates his house in the neighborhood of low, damp, foggy land which he neglects to drain, and thus make the air more healthy and the soil more productive. We are so thoroughly convinced of the importance of drainage that we put this down as the first step in successful agriculture, and hope future committees will not have to lament that no reclaimed lands were offered for their inspection.

The apathy on the subject of fruit is not much less than in the matter of wet, unproductive lands, if we may judge from the number of orchards entered for a premium in 1867, as only two apple orchards and one of pears were offered for our inspection. "Good fruit and plenty of it," should be the maxim of every farmer. Fruit seems to have been the staple diet of man while in the Garden of Eden, and is what all crave, especially those living in the temperate and torrid zones. The eagerness with which children seize even immature fruit, proves the inherent longing in our natures for the cooling antiseptic and refreshing influences which fruit furnishes. With more apples, pears, peaches and grapes, and less meat, our systems would not be strained so constantly to their utmost tension, and we should have less dyspepsia and neuralgia. We can have, and should

have, an apple to eat every day in the year, and the modern mode of excluding air by canning, enables us to be furnished with all manner of fruits in fresh condition at all seasons. We call no farm perfect without its apple and pear orchards. The apple of late years has been a little coquettish in its habits, and some may have been discouraged from cultivating this most productive and most useful of the fruits. Let such remember that even in our most unproductive seasons, more and better apples are raised in the northern and western sections of our country than in any other part of the world. Our soil and climate as a whole are exceedingly well adapted to this fruit, and nowhere does it find a more congenial home. Others have feared that, by the great increase of nurseries, and multiplication of orchards, the market for apples would be overstocked. We need only to remind these fearful ones that the price of apples has steadily risen in our country. The increase in demand has more than kept pace with the increase of orchards, so that the price of refuse apples, fit only to be made into cider, is now more than our fathers could obtain for choice winter fruits. They thought themselves fortunate if they could obtain one dollar per barrel for picked, grafted apples. We are not content unless we realize four or five times this amount. Cider, that most healthy of all the vinous beverages, was formerly sold by the barrel for about the same that it now brings by the gallon. The foreign demand for apples has also greatly increased. England, with her foggy atmosphere, intercepting the solar rays, cannot produce the high colored and high flavored fruit peculiar to our country, and will most gladly purchase all our surplus production. But so far, we have had little surplus, for comparatively few, even in our favored land can say, they have all the fruit they desire. Let no one then be discouraged by an occasional unfruitful season, or by fear of an overstocked market, from planting apple orchards. We hope soon to see some remedy devised against the attacks of the curculio and other insects, which now are the pests of our orchards, and if no other more profitable disposition can be made of our apples, our cattle and swine will consume all we can raise.

While apples of late years have become a rather uncertain crop, the vigor of pear-trees has increased, and their variety and

quality must now satisfy the most fastidious. The old maxim was,

> "He that plants pears,
> Plants for his heirs,"

but, thanks to Van-Mons, and other pear culturists, we can plant pear-trees one year and gather fruit from them the next. While the pear is not so lasting a fruit as the apple, it is more luscious, and both for the dessert and for cooking is more universally liked, and commands a much higher price. We hope therefore to see more pear orchards started in the county.

The roots of the pear-tree run more perpendicularly into the ground than the apple. Pears, therefore, require a deep, dry soil, and are less injured by the extreme droughts to which our climate is exposed. As their limbs also run up more perpendicularly they will bear to be planted more closely than the apple, so that on a given plot we can plant twice as many pear as apple trees.

A mistake of many young orchardists is to put out too great a variety. There is only *one* best variety. Amateurs differ as to which is the best, but all agree that the varieties of both apples and pears which are letter A, are few in number.

Another mistake is to plant too closely. While the young trees are mere whip-stalks, they seem far enough apart, but ere we are aware, their branches are interlaced and the sun's rays are excluded.

ALEXANDER HYDE, *Chairman.*

GRAIN CROPS.

MIDDLESEX SOUTH.

Statement of P. McMahon.

INDIAN CORN.—Seven acres of corn entered for premium has been a pasture, ploughed, April, 1869, with a Michigan plough:

Expense, ...	$21 00
140 ox-loads of barn cellar manure, . . .	280 00
Spreading and ploughing with one horse, . . .	10 00

Planted May 12–15,		$10 00
First hoeing, June 1–5,		14 00
Second hoeing, June 20–25,		12 00
July 5–15, third hoeing,		12 00
		$359 00
Half value of manure,		140 00
Total expense,		$219 00
Tops and stover for the harvesting; 1,193 bushels of sound ears; shelled corn, 596 bushels, at $1.25 per bushel,	$747 50	
Sixty-five bushels of poor corn,	24 25	
Sixty-seven bushels potatoes, 75 cents per bushel,	50 25	
Two bushels of white beans,	5 00	
		827 00
Profit,		$608 00

This field was marked three feet eight inches apart each way, thinned out four in a hill. Pulled off the suckers middle of July. Manure well, and do likewise, and you will raise good corn. PATRICK McMAHON.

PLYMOUTH.

Abstract of Statements.

INDIAN CORN.—Albert Thomas, of Middleborough. From the statement of Mr. Thomas, duly filed, it appears that the land on which he raised his corn crop in 1868, (the experiment not having been completed at the time of making up the last annual report,) measured one hundred and sixty-seven square rods, of dark, sandy loam; in grass, without manure, in 1866 and 1867; fifty loads, of thirty bushels each, of barnyard manure ploughed in, in April, 1868; the ground harrowed and furrowed three feet by three and one-half feet apart; planted, May 30, with Whitman corn; cultivated three times and hoed twice; harvested about November 1. Product, 182 basketfuls of ears,

weighing 45 lbs. to the basketful, making 8,190 lbs., which, at 85 lbs. to the bushel, gives $96\frac{60}{85}$ bushels. One basketful, kept till December 1, weighed $41\frac{1}{2}$ lbs., and yielded 34 lbs. shelled corn, being, at that rate, $5,541\frac{1}{2}$ lbs., or $98\frac{53}{56}$ bushels per acre. The same corn, kept till January 1 following, and being then very dry, weighed $32\frac{1}{2}$ lbs., giving, as the merchantable product of an acre, $94\frac{33}{56}$ bushels of corn and $2\frac{1}{2}$ tons of stover. Expenses: Ploughing and harrowing, $7.50; manure, $50; seed and planting, $6; cultivation, $7; harvesting, $7; total, $77.50. Value of crop, $$163.12\frac{1}{2}$. Profit, $85.62.

1869. Spencer Leonard, of Bridgewater. One acre of sandy loam, inclining to clay; in grass, without manure, in 1867 and 1868; thirty loads of manure, of thirty bushels each, ploughed in May 12, 1869, from seven to eight inches deep; the ground thoroughly harrowed and furrowed; planted, May 14, in hills three feet five inches apart one way, and about half that distance the other, putting four kernels of smutty white corn in each hill; hoed four times with horse-hoe and twice with hand-hoe; the stalks cut and fed to stock in September, and the corn harvested in the latter part of October. Product, as computed from an average rod harvested by the supervisor, $108\frac{20}{85}$ bushels of corn and four tons of stover. Expenses: Ploughing and harrowing, $5; manure, $55; seed and planting, $4.50; cultivation, $10; harvesting, $15; total, $89.50. Mr. Leonard says, in his statement: "A small portion of my corn land was ploughed in the autumn of 1868. This portion was manured like the rest, in May, 1869, and ploughed only about four inches deep. There was no perceptible difference in the corn on these different portions. Some slight injury was done by the wire-worms early in the season, and later, on the higher and dryer portions, by the white-worm. Otherwise it has made a very even and regular growth, and ripened well. The manure used was from my barn cellar, about one-fourth of it being soil, and the remainder the droppings from my cattle and horses, worked over and enriched by three swine. A small handful of hen-manure mixed with soil was put in each hill. The corn crop appears to be a paying one, notwithstanding the statement of Mr. Pratt and others that corn raising in Plymouth County doesn't pay."

Albert Thomas, of Middleborough. One acre of dark, sandy

loam, in grass, without manure, in 1867 and 1868; forty loads, of thirty bushels each, of manure from the barn cellar ploughed in seven inches deep in May, 1869; the ground harrowed and furrowed out in rows about three feet apart; planted, May 10, with Whitman corn, putting about ten bushels of hen-manure and ashes, in equal parts, in the hills; cultivated and hoed three times; harvested about November 1. Product, computed from an average rod, ninety-five bushels; stover valued at $12. Expenses: ploughing and harrowing, $6; manure, $40; seed and planting, $3.50; cultivation, $10; harvesting, $7; total, $66.50. Value of crop, $130.75; profit, $64.25.

James Howard, of West Bridgewater. One acre of stiff, heavy loam, with clayey subsoil, wet and springy; in grass, without manure, in 1867; in corn in 1868, manured with forty loads, of thirty bushels each, of barn cellar compost, ploughed in, December, 1868; forty-five loads of compost ploughed in, seven inches deep, in April, 1869, and mixed with the soil by using a Ross horse-hoe, and two hundred and thirty pounds of ground bone, composted with ashes, put in the hills; planted May 13, in rows three and one-half feet apart, the hills sixteen inches apart in the rows, putting two kernels of corn in each hill; on one-third of the piece early yellow corn, on the other two-thirds white corn; cultivated twice with Ross cultivator, and hoed twice; stalks cut about September 18, and the corn harvested October 15 to 18. Product, 57$\frac{1}{7}$ bushels of corn, and about three tons of stalks and husks. Expenses: Ploughing, &c., $7; manure, $53; seed and planting, $4; cultivation, $10; harvesting, $10; total, $84.

Mr. Howard will scarcely expect a premium on his corn, yet, as his statement contains some valuable suggestions, the supervisor recommends that he be paid a gratuity of $6. He says: "As my corn crop was not more than two-thirds of what I expected when preparing my land, perhaps some suggestions as to the causes of failure may not be inappropriate. This land has a wet, cold subsoil, which possibly might be much improved by under-draining. The early part of the season being wet and cold, the corn did not come up well, and it became necessary to replant it, thus making it late in starting. The bone compost is not as forcing as some other manures, although, on another piece of higher land it produced a noble crop of corn this year.

My corn being thus late, was much injured by the September gale. Perhaps it was injudicious to plant corn on the same land two years in succession; but the best corn I ever raised grew on land planted to corn the previous year."

WHEAT.—Charles C. Thayer, of West Bridgewater. One hundred and seventy-three rods of gravelly loam; in corn in 1867, manured with fifteen loads of barnyard manure, of thirty bushels each; in potatoes in 1868, manured with sixteen loads of similar manure; ploughed September 8, 1868, seven inches deep; one hundred bushels of ashes harrowed in; six pecks of blue stem wheat sowed September 12, harrowed in, and the ground rolled; harvested the last of July by cradling. Product, 1,856 pounds of wheat, being at the rate of 1,716 pounds, or $28\frac{36}{60}$ bushels per acre, and 3,000 pounds of straw. Expenses: Ploughing and other preparation, $5; manure, $22; seed and planting, $4; harvesting, $14; total, $45.

James Howard, of West Bridgewater. One hundred and sixty-two rods of stiff, gravelly loam, with a small percentage of clay; in corn in 1867, manured with fifty loads, of thirty bushels each, of manure from the barn cellar; in corn in 1868, manured with twenty-five loads as before; ploughed, September 17, 1868, about six inches deep; one and one-half bushels of white flint wheat sowed September 18; harrowed, bushed and rolled; cradled July 19, and threshed with hand-flails. Product, 1,580 pounds of wheat, being at the rate of 1,560 pounds, or twenty-six bushels per acre very nearly, and 2,500 pounds of straw. Expenses: Ploughing and other preparation, $3; seed and sowing, $7; harvesting, $14; total, $24.

In his statement, Mr. Howard says: "My wheat crop, when harvested, was worth $86, and, with flour at prices it averaged two years ago, would have been worth $125. I think the attention of farmers in this vicinity should be called to the advantage of producing their own bread. More value of wheat can be raised upon an acre, at the same expense of labor and manure, than of Indian corn. Winter wheat, raised on our own farms, will make better flour than is found in the market. I think Plymouth County farmers should aim to produce such crops as they require for their own consumption, when it can be done economically. I would not, by this statement, influence any one to scatter seed, hap-hazard, upon any piece of land, at

any season, without knowledge or careful preparation, as such a course would be sure to result in disappointment. But with suitable care, and the exercise of the same degree of knowledge and skill necessary to insure success in other business, wheat-raising will be found as satisfactory as any other branch of farming. I find it more and more so, after twenty years' experience."

ROOT CROPS.

ESSEX.

Statements of H. L. and W. W. Phelps.

Potatoes.—The acre of land entered by the undersigned for premium, is situated on the south side of a hill. The soil is a gravelly loam, with here and there a slight mixture of clay. Grass has been the annual crop since 1856, and in 1867–8 it was hardly worth cutting, as no manure had been applied for several years. It was ploughed once, about six inches deep, late in the fall of last year; cost $5. Harrowed early last spring; cost $1. As soon as harrowed, eighteen loads of well rotted manure were hauled upon the ground, and piled; estimated value $35. The potatoes were planted April 16–22. The land was furrowed, making the furrows four feet apart and eight inches deep; the manure was spread evenly along the furrow, and the seed which had been cut, leaving but one eye on a piece, was dropped upon it about nine inches apart, and covered four inches deep. Five bushels of seed were used, four of Early Goodrich and one of Garnet Chili, costing $1 per bushel; cost of planting $15. May 27th and 28th it was cultivated with a horse hoe, and hoed, the potatoes at that time being about six inches high. June 10th and 11th it was ploughed and hoed. This being the last hoeing, they were hilled as much as possible; cost of cultivation $12. July 21st, and August 25th, dug 21,600 pounds of potatoes, of which 320 bushels were merchantable.

The above statements are correct, to the best of my knowledge.

W. J. Dale, Jr.

North Andover, November 9, 1869.

Statement of Charles L. Perkins.

POTATOES.—The land upon which the potatoes which I offer were grown, is a dark, gravelly, loamy soil; has been planted with onions the last thirty years, with the exception of last year when it was planted with Swedes turnip. The piece of ground contains one hundred and eighteen rods, was manured the first week in May with three cords of barnyard manure, ploughed seven inches deep, harrowed with an iron tooth harrow and brushed twice over with a brush harrow, drilled three feet apart and planted with three barrels of Harrison potatoes. The seed potatoes were cut, and two small pieces, or one large piece put in a hill. The expense of cultivating, as near as I can estimate was:—

For hauling and spreading manure, ...	$3 00
Ploughing, harrowing and drilling, ...	4 00
Planting $1.50; cultivating and hoeing twice, $5, .	6 50
Harvesting, ...	10 00
	$23 50

For some cause, perhaps owing to the drought in July and August, the tubers formed on the joints of the vines, thus reducing the crop considerably. The hills, where the potatoes formed on the vines, outside of the hills, did not yield more than half as much as the hills where the potatoes formed inside. The potatoes weighed 18,172 pounds; at sixty pounds to the bushel, there is three hundred and two bushels and fifty-two pounds.

Statement of Paul Ilsley.

ONIONS.—The crop of onions which I enter for consideration was grown upon a soil of gravelly loam, the land sloping slightly towards the south-east. The crop the year previous was onions. I ploughed in the fall, turning under about seven cords of barnyard manure, to the acre. Manure composed largely of salt marsh muck. I sowed, about the 25th of April, in drills, thirteen or fourteen inches apart, about three and one-half pounds of seed to the acre. In cultivating, use the wheel hoe, going over the ground seven or eight times, and weed thoroughly four times. The crop this year was pulled the middle of September, and

topped on the ground, and housed two or three weeks later. The result was 610½ bushels of ripe onions on an acre.

Value of manure, estimated,	$75 00
Cost of preparing ground,	12 50
Cost of seed and sowing,	29 00
Cost of cultivating,	45 00
Cost of harvesting and topping,	36 00
	$197 50

Statement of J. J. H. Gregory.

CARROTS.—The piece planted to carrots was tile-drained a year ago last spring and then planted to carrots. This spring it was liberally manured with a compost of muck, night soil, sea manure and barn manure, at about the rate of eight cords to the acre ; it was ploughed about eight inches deep, and very thoroughly worked. About the middle of June it was planted to the Improved Long Orange carrot, the short top variety, in rows fifteen inches apart, seed being dropped at the rate of one pound to the acre. The season being unpropititious, the plants averaged thinner than was desirable. After the carrots were three or four inches high, they were thinned where too thick, to three inches apart, with the exception of a small portion of the bed, which was overlooked. All after cultivation, was by finger weeding and the slide hoe. The yield was five hundred and twenty-three bushels from ninety-five rods of land, or at the rate of twenty-two tons to the acre.

Statement of J. L. Newhall.

MANGOLDS.—The crop of 1867 was grass without manure; the crop of 1868 was grass without manure, on half the piece, the remainder was in cabbage with manure, at the rate of four cords per acre, and a handful of ashes to each hill. The land was ploughed in the fall of 1868, and again in the spring of 1869. At the last ploughing, about eight cords of manure were ploughed in ; the land was then harrowed and turned into ridges three feet apart, with the plough, and the seed sowed on the top of ridges, four pounds of seed required for this piece. Cost of seed, $4.80 ; planting, $2 ; cost of ploughing, $5 ; other preparation, $5 ; value of manure on land, $64.

The piece was cultivated with horse cultivator three times,

and the weeds pulled from the rows. Cost of cultivating and weeding, $20. The crop was gathered about the middle of October; the roots were stripped of leaves and thrown into rows of four rows each, in the forenoon, and in the afternoon carted to the cellar. Cost of harvesting crop, $15. Product of 147 rods —29 tons 140 pounds.

Statement of H. F. Longfellow.

SWEDISH TURNIPS.—The land on which the turnips were raised was broken up in 1867 and planted with potatoes; in 1868 a crop of corn was raised upon it. Each year it received about thirty loads of manure to the acre. The piece which I enter is part of my field of three acres, and was manured with thirty-three loads of barnyard manure, spread broadcast and ploughed in to the depth of four inches, and then thrown into ridges, thirty inches apart, with a double mould-board plough. A heavy brush harrow was then passed lengthways over the ridges, leaving them so smooth that the seed was easily sown with a common brush seed sower, on the 24th of June. The plants were thinned to the distance of nine inches. The seed used, was Skirring's King of Swedes and Carter's Improved, at the rate of one and one-third pounds to the acre. Both varieties are *good*. After hoeing once, the weeds were pulled by hand. The three rods selected as an average, by a member of your committee, Mr. Perkins, were harvested on the second of November, and the turnips, after being relieved of tops, dirt and roots, weighed 1,060$\frac{7}{8}$ pounds—56,580 pounds, or 943 bushels to the acre, which I think is the largest crop ever offered for the society's premium, and if it had not been for the drouth of July and August, I think I should have raised 1,200 bushels to the acre.

COST OF CROP.

Manure, hauling, and spreading, ...	$60 00
Ploughing, ridging, and harrowing, ...	3 50
Seed, hoeing, weeding, thinning, and harvesting, .	23 33
Interest on land, ...	6 00
	$92 83
CR. by tops and small turnips, ...	12 83
	$80 00

Making the cost per bushel, at previous estimate, eight and one-half cents. The price of ruta-bagas varies from $1 to $2.25 per barrel.

Statement of J. L. Newhall.

Ruta-Bagas.—The crop of 1867 and 1868 was grass without manure. Ploughed in the fall of 1868 about eight inches deep, again in the spring of 1869 six inches deep, and just before sowing, about six cords of manure were ploughed in to the depth of six inches, the ground harrowed and about 200 pounds of superphosphate applied broadcast, the surface was then thrown into ridges, and one and one-half pounds of seed, cost $1.05, sown on the top of these ridges. Value of manure on land, $54; cost of ploughing and planting, $12; the crop was cultivated three times and weeded twice; cost of weeding and cultivating, $15; the crop was harvested the last of October, the roots were pulled and topped and thrown into piles in the morning, and carted to cellar in the afternoon. Cost of harvesting, $10. Product of 136 rods, 17 tons.

VEGETABLES.

ESSEX.

From the Report of the Committee.

Any thrifty housewife who was compelled by untoward circumstances to drop into the dinner pot an onion weighing one pound, or a turnip beet weighing six pounds, would consider herself unfortunate, and when "boiled dinner" came to the table John would not be expected to go into raptures over the thick, coarse, sloughing layers of the onion; the stringy, flavorless beet. Now an onion is grown for table use only; and, as a rule, turnip beets are grown for table use only. Why then should a false standard be encouraged on our exhibition tables by awarding premiums to specimens of these two vegetables, whose size would render them utterly worthless for the table, the only use now made of them.

The carrot has a double use, being cultivated for the table, and for stock; for our tables we want the sweetest, the finest grained, and the richest flavored of all the numerous varieties. This we have in the Early Scarlet Horn, the earliest of all. This is a short carrot, growing about three inches long and two in diameter, but it will bear planting in rich land three inches deep. For feeding stock, the size is of primary consideration; this we find in the White Belgian and large Orange varieties. The White Belgian will yield a quarter more than any other variety, and growing partly out of the ground, a large part of the crop can be pulled by hand. For horses this is a good carrot, but for the butter and milk of dairy stock, we want the rich color of the Orange varieties, and the best of these is the short top, half long, otherwise known as Improved Long Orange, and locally known as the Danvers Carrot. This carrot has a greater diameter near the surface than the Long Orange planted at the same time, while being shorter, it is more easily pulled and less liable to break in the ground than that variety.

The parsnip is at present, grown almost entirely for the table, and at the best, we do not, ordinarily, by October grow a very large root, other conditions being equal; to the largest root, I would award the highest premium. I think that the day is not far distant when our Jersey Cows will be treated in winter to the root on which they are almost reared in their native island, the parsnip. Shallow, dry, stony, or anything but the richest of soil is unpropitious for a good growth of the parsnip; but peat meadows, to the reclaiming of which so much attention is given of late years, are most excellent for growing the parsnip, and all other roots to the largest size; and when the best possible result is sought in our Jersey Cows, in the condition of the stock, and the quality of butter and milk, then the rich, sweet parsnip will have its day. For family use, on deep soil, the improved varieties such as Abbott's and the Student's, which taper quickly from the top, are preferable, while for shallow soil the little turnip rooter, of nearly the shape of a flat turnip, is a gem.

I believe of beets, as of parsnips, that a day will come when the condition of quality will so far enter into our consideration that we shall grow the turnip and long blood beet to feed to stock. By planting early in the season in rich soil and thinning

to a foot apart, a growth of from ten to twelve pounds can be attained, and I have had isolated specimens weigh over twenty pounds. While the mangel-wurzel afford us but little else than water, the common beet is a saccharine vegetable, and the sugar, besides improving the quality of milk, adds fat to the animal. Let me here make a seedman's suggestion to my brother farmers,—when you see sugar beets, or white sugar beets advertised in catalogues, remember it means a variety of mangel-wurzel, used largely in Europe for the manufacture of sugar—preferred to other sorts because it has but little coloring matter in its composition, and utterly worthless for table use.

As an early short top, the Early Flat is desirable, while for a handsome round beet, excellent for the family, or the market, Dewing's is an acquisition. Simon's Early is a favorite with the Philadelphia marketmen. The half long varieties, such as Henderson's Pine Apple, Castelnaudary and Crapaudine, are rather small in size, but of excellent quality.

In mangel-wurzel, what we want, is size and quality, though as ordinarily grown, we have in view quantity only. If the variety of mangel-wurzel, alluded to above, had no more sweetness in it as grown in Europe, than most of those fed to our milch cows, "the bottom would be knocked out" of their sugar enterprise in a single season. Let the experiment be tried of growing under the same condition, a piece of mangolds, one on high and one on low land. When the crop is gathered, those on the lowland may be larger, but those on the upland will be sweeter. If the farmer is only desirous of increasing the *quantity* of milk, he will feed mangolds from lowland; if he has regard also to the condition of his animals, he will feed mangolds grown on upland, and I will add if he aims at producing butter, he will feed carrots rather than mangolds. I know of no more common error in dairy matters, than in the time at which mangolds are fed to cows. Most vegetables undergo a change in their nature, after they are gathered and stored,—some potatoes undergo a ripening process, so that the characteristics of October are not the characteristics of March; in a few months our turnips become "corky" and the seed of our running squashes do not fully mature until from one to four months have elapsed from the time they were gathered; so of the entire beet family of which mangolds are a class. In the sugar making countries of

Europe, it is found necessary to store the sugar beet awhile, until certain changes shall have taken place in its nature, before it is in a condition suitable for use. So in the mangold, it is necessary that some important change should take place in its nature before it can profitably be fed to stock; if fed liberally, early in the season, it will scour the cows; feed ruta-bagas, carrots or cabbages early in the season, and feed the mangolds towards spring.

If planted before the first of June, the long red mangold is apt to have a long, woody, hollow neck by harvest time. I would recommend the ovoid varieties as preferable in this respect, besides being of more compact growth, and having fewer lateral roots. The yellow globe is an excellent sort for a sandy soil. If our farmers would be brave enough to have their rows thirty inches, and thin their plants to fifteen inches apart in the row, when young, they would find that they could do about all their tillage with the cultivator and hoe, while they would have as much weight in the crop, and the pleasure of handling mangolds as big as their thigh, instead of as big as their arm.

As turnips are grown both for family use and for stock, we need to encourage good specimens of all sizes at our annual exhibitions. Of the ruta-baga or Swede class, the best for family use is the white variety, known as "Sweet German." This excels in its sweetness, crispness and keeping qualities. It is also an excellent turnip for stock. The demand for this variety has increased wonderfully within a few years; whereas twenty years ago it was rare to see a barrel of the white ruta-bagas in Boston market, almost all sold being of the yellow sort; now ten of the white may be seen to one of the yellow. Of the yellow varieties, Skirvings has been exceedingly popular, but though it forms good bulbs, the long neck that goes with them is an objection, and Laings, London and Shamrock Swedes are now preferred.

In testing about a score of flat turnips, American and foreign, I have found our white and purple strap leaf the earliest; yet I think it is not generally known to our farmers that these are the most subject to the attack of the worm of the whole class of flat turnips. Yellow Finland, Improved Yellow Globe and Cowhorn are preferable in this respect.

Of onions, the standard for an excellent table article is found among those that are not over three inches in their greatest diameter, with a fine, close skin, thin, compact layers, a small neck, with the whole bulb feeling about as hard, when handled, as a stone. The Large Red Wethersfield onion is the latest in maturing, and a large percentage makes but scullions, even under the best of treatment; while the Early Red Globe grows to as large a size, crops equally well, and the onions are among the most symmetrical, and in earliness are among the earliest. For these reasons, as would be inferred, it is fast superseding the Late Red where it has been introduced. The Early "Cracker" onion, when I first introduced it to the general public, was remarkably early, but quite thin, and therefore would not measure well when marketed. For the past two or three years, while retaining its earliness, it has grown much thicker, and now so closely resembles the old Flat or Strasburg onion, that the public would be decidedly a gainer if they would throw overboard that late variety, and substitute in its place the "Cracker," which matures fully two weeks earlier, a characteristic of vast value, in short seasons, to the onion farmers of the North. For general crop, in Essex County, the Early Danvers rules the market, and we know of no variety for a standard onion that deserves to replace it. The Potato onion is the earliest of all varieties, and, when used as early, is the sweetest and tenderest of all onions; but after summer has past, it soon becomes tough and unsuitable for the table. I would advise all farmers to plant a quart or so of the potato onion sets, to be used in the family before those raised from seed get sizable.

The largest cabbage of its kind is usually the best, and among our greatest cabbage-eating class the largest cabbage of the largest kinds always find a ready market. For these reasons it is desirable that we should encourage at our exhibitions the largest specimens of all varieties where such specimens have hard and handsome heads. The largest cabbage of its kind, other things equal, is the best; because, to attain this extra size, it must have grown faster than its fellows, and having grown faster it is therefore more tender, and being more tender, under these circumstances, it is also the sweetest. The Marblehead Mammoth is our standard large cabbage in Essex County, and when the market is within a few miles, it is a capital sort

to raise for our Irish and German brethren; but where the market is more distant, or there is mostly a different class of customers, then the Stone Mason and Fottler become standard sorts. For family use, the Savoy family are decidedly the best, having that rich, marrow-like taste that belongs to no other class of cabbages. The Early Ulm Savoy is as early or earlier than Early York, and, with the Improved American Savoy, is as reliable for heading as any cabbage grown. I have been experimenting with over sixty foreign and native varieties this season, of which I may have more to say at some other time.

When the Autumnal Marrow, or Boston Marrow squash, as it is usually called, was first introduced, it was of small size, weighing about five or six pounds; it cooked very dry, was fine-grained and of excellent quality. At the present time it is usually watery, often coarse-grained, and poor in quality; we have utterly lost its fine qualities for the table. Within a few years, the American Turban, as a fall squash, and the Hubbard, for winter use, have, to a large extent, replaced the Marrow upon our tables. In these two we find the chief good characteristics of the Marrow when in its palmiest days, and, in addition, superior keeping properties which characterize these two fine varieties. As a general rule, the Turban and Hubbard are too grainy in their texture to enter into the structure of that grand Yankee luxury, a squash pie. For this the Marrow excels, and this, I hold, is now the proper sphere of this squash; it is now a pie squash. Where dryness, sweetness and quality for the table are sought for, we find these, as a rule, in squashes of medium size, those weighing from six to ten pounds. This, therefore, I hold, should be the standard encouraged for a table squash. If we select large specimens for seed stock, we find, in practice, that there is more of sport in the crop; that the Hubbard gradually loses its shell and grows coarse in structure, while the Turban tends to develop the cross of the French Turk's cap that is in its blood, which gives it size at the expense of quality. Because this is so, and because the temptation among marketmen is to raise weight at the sacrifice of quality, I hold that our premiums should point emphatically to the correct standard of weight in these two prominent table squashes. Discussing the Marrow as a pie squash (and I find that the most intelligent of the market-gardeners around Boston agree with

me,) I hold that our premiums consult the best welfare of both consumer and producer, when they encourage the largest crop possible consistent with a sufficient fineness of structure for pies. It is my opinion that for this use the Marrow squash can safely be grown to average from twelve to fourteen pounds in weight. The idea entertained by many good farmers, that special aim should be made to grow the Marrow as small sized as formerly, when it was so excellent a table squash, based on the idea that by so doing we can get the old excellence back again, is a delusion, as is proved by the fact that, with all the efforts in this direction, the old excellence has not been recovered.

The annual exhibition of vegetables this season was hardly up to the usual standard. We particularly missed the great variety usually displayed by Mr. Merrill, who for so many years has been the right hand of the society in this department. As the exhibitors had no standard in common to guide them while selecting their various kinds of vegetables for the annual fair, I hardly feel that the quality of the vegetables was open to criticism. There was a large variety on the tables, and some fine specimens of the various standard kinds.

It would greatly improve our vegetable exhibitions if the same plan was pursued as has been adopted in the fruit department —that of offering special premiums for each standard vegetable, the number of specimens required of each kind to be stated, and the standard of excellence to be briefly given. The Massachusetts Horticultural Society has practised this in part for the past few years, with marked improvement in its annual exhibitions. In its printed programme the society has confined itself to specifying how many in number or how much in measure of each vegetable was required to compete for the premiums offered. I propose that our ancient society become a pioneer in a still further improvement, and fix a standard of excellence in the several vegetables, so far as the characteristics present themselves to the eye. The experience and good judgment of the vegetable committee of the Massachusetts Horticultural Society has usually assigned premiums to the most deserving of their kind; yet, in their exhibitions, anomalies have been presented that would be impossible under the more matured system that I propose—such as prominent premiums assigned to over-

grown potatoes, overgrown squashes, to Hubbard squashes that were but little more than half matured, the color being of a deeper green when in that stage—one year awarding premiums to the largest, coarsest onions, the next to the ripest. I fully believe that our society would promote the best interests of the community, and add much to the educating value of its exhibitions, if it would define in general terms what a premium onion, potato, squash or other vegetable must be.

There can be no good vegetables without good seed; and the more hands seed passes through before reaching the end of its journey—the seed drill of the farmer, the greater the chances are of its being too old, impure, or wrongly named. I hold, therefore, that the Essex Agricultural Society has done a wise thing in directing its attention of late years to the matter, and offering special premiums for seed grown within the limits of the county. It is very difficult for the farmer who has had the misfortune to handle worthless seed, to fix the responsibility on any one; it has passed through several hands, and "he told me so," is the catch phrase of the entire series; but let the seed be grown in its own neighborhood and the direct responsibility is a powerful stimulus to the utmost honesty and highest care on the part of the grower, while it proportionally increases the confidence and profits of the planter. There are three positions taken by prominent societies in New England in respect to the exhibition of vegetable seed: the Massachusetts Horticultural Society not only does not offer any premiums for vegetable seed, but goes farther than this, and positively refuses to have any exhibited on its tables. As several of the prominent men who are active members of that society are seed dealers this action appears anomalous; but a knowledge of the fact that under the by-laws of that society the exhibitor must have grown his own seed, naturally tones down all surprise. The New England Society offers premiums simply for garden seed, without any condition that it shall have been grown in or out of New England, or that the exhibitor shall have raised a grain of it. The obvious effect of such a course is simply to encourage the production of seed as a commercial article. Our own society in offering premiums for a home grown product, encourages a very important branch of agriculture in our midst, annihilates the vast intervals that

usually exist between the producer and the planter, and keeps a wholesome responsibility within easy access of the purchaser.

For the Committee,

JAMES J. H. GREGORY.

NANTUCKET.

From the Report of the Committee.

In making our awards the present year, we would say that in no year since the formation of the society has the duty been more agreeable or satisfactory than in this, from the fact that the display of vegetables uniformly excelled in size and quality the exhibitions of former years, thus showing a decided improvement in the method of cultivation among our farmers. It will be gratifying to our agriculturists to know that it was the opinion of the State delegate, and also of those friends who visited us from abroad, that our show of vegetables cannot be excelled by any similar exhibition in New England, expressing at the same time a very favorable opinion of the capabilities of our soil when properly managed.

In view of the increasing importance of agriculture as a means of subsistence in the county, your Committee would offer a few suggestions relative to a method of fertilizing the soil not heretofore practised among us. We refer more particularly to the ploughing in of green crops. The scarcity and consequent high price of manure on the island, creates an imperative demand for some cheaper method of rendering the land productive, and your Committee believe that such a method will be found in the practice above referred to. According to the best information which the Committee have been able to obtain, the practice has been attended with entire success in those sections where it has been adopted, and should like results be obtained here, it would certainly be of great importance to our agricultural interests.

In order to convey to our farmers some idea of the practical utility of this system, the Committee would here introduce a statement made to one of their number by a gentleman from Illinois, who visited the island in the summer of 1866 and 1867, and spent some time in looking over the land and noticing the capabilities of the soil, and being himself a practical farmer, his

opinion should be entitled to some consideration. Said he, why is it that so large a portion of your island lies uncultivated, while so many of your people are seeking employment? Simply because the land is barren and unproductive. But why not go to work and make it productive? Because the expense of manure, &c., would make it cost more than it would yield. Then, said he, make it without manure. As this idea struck us as being the quintessence of absurdity, our only reply was a prolonged stare. The gentleman seemed amused at our perplexity, and presently inquired whether we had ever practised ploughing under green crops as a means of manuring the land. We replied, that as far as we knew, no such practice had ever obtained in this county, and expressed our doubts as to its being any cheaper than the ordinary way of manuring. To this he replied that he would relate the experience of a neighbor of his, which came under his own observation, and which might perhaps tend to alter our views on the subject.

Some six years ago, said he, there came a man from the Eastern States to Illinois, and located on a tract of barren land, for which he paid five dollars per acre. Having exhausted his means in purchase of the land, he commenced work for his neighbors, and as soon as he had earned enough to purchase seed, he had the land ploughed and sown with mammoth clover. This crop in due time he ploughed under, and then put in barley, which at maturity he cut as high as possible, turning under the stubble, and threshing out the grain, which he sold for enough to pay the expense of seed and ploughing, leaving a surplus equivalent to one dollar and a quarter per day for each day's work which he himself had done on the land. This process he repeated, and at the end of five years the land was in a condition to raise one hundred bushels of corn to the acre, and other crops in proportion. He is now offered two hundred dollars per acre, which he refuses. Now, said he, I have passed over hundreds of acres of your commons, which I consider better land to begin this process upon than the land of which I have been speaking.

In view of the above statement, the Committee would suggest to the society the propriety of ploughing an acre of ground in their enclosure, with the view of testing this method for the

benefit of the agricultural community. The experiment is worth trying, and we believe it would pay its own expenses.

So many conditions are to be observed for the growth of vegetables, that the subject demands the most careful research. Climate, soil, planting and cultivating, are the requisites for growth. We are all aware that much of our island soil is very light and sandy, with but little depth. Constant crops in former years have nearly exhausted hundreds of acres of upland. Cultivating without manures has been the ruinous policy. This spoliation system has to a serious extent impaired the productiveness of our common and undivided lands. The practice of seeking the greatest possible production at the least possible cost, has impoverished the soil on thousands of acres of the more fertile lands of other States. Where cultivation has been easy, past generations have taken ever from the soil, giving little in return, leaving to their successors the almost hopeless task of restoring what their ignorance or stupidity had destroyed; and many of the present generation are too faithful imitators of the practice of their ancestors. Men buy land too often for the same use as they do cattle—to wear out. Measuring the result by the money received, they consider the business profitable. Were all to adopt this system, the earth would soon become a barren waste.

We have a number of mineral chemicals which are being tested for fertilizers by the scientific agricultural world. Guano is thought by some to be excellent for grain or vegetable crops. Potash is said to be the most valuable mineral alkaline substance that can be used, as it decomposes the mineral substances in the earth. This may be returned to the soil in wood-ashes; they contain nearly all the mineral elements necessary to vegetation. Common salt may be safely used with manures, as it decomposes vegetable and mineral matter. Lime is a powerful agent, and will in many ways benefit the soil and hasten vegetation. It is said that two hundred pounds of lime and two bushels of salt, mixed together, dry-slack under cover. Sow the mixture on the surface in the fall; cultivate in, if sown in the spring, to incorporate with the soil. If for potatoes, use a little in the hill; from four to five hundred pounds of lime to the acre is a fair dressing. Bones are of great value; they contain one-third organic and two-thirds mineral. Many other

minerals may be applied to soils with success as restoratives. Soils may be improved by mixing one with another; if clay predominates, it should be amended by sand; if the soil is too sandy, by an admixture of clay.

Close and intelligent observation will enable every farmer to determine what character of land is best adapted to each crop, and what crops should succeed each other. We want more labor and a rotation of crops. An eminent agriculturist has said: "We not only want more capital, but we want more labor—a great deal more of it." There is nothing in which our farmers come so short as in the employment of labor on their farms. The profit comes from skilful working of the land.

We would not overlook the value of our barn and stable composts, for they are the most important resources we have for fertilizers; but the amount is by far too limited for our hay lands, cereals and tillage, and substitution must be resorted to for vegetables.

Time and space will not allow us to more than hint at these systems by which our lands may be made much more productive. We believe that maximum crops of from seventy-five to one hundred bushels of corn, and three hundred to four hundred of potatoes to the acre, can easily be produced, by skill and labor, on some of the lightest lands in our county.

ALEXANDER MACY, JR., *Chairman.*

FRUITS.

HINGHAM.

From the Report of the Committee.

So favorable a season for the successful cultivation of grapes has not been experienced in this vicinity for a number of years, and the results were apparent at our exhibition in the large number of contributions and the beautiful appearance and ripeness of the fruit. Yet this season must not be taken as an index of what may be the result in the future; on the contrary, we must rather judge from the experience of the past ten years, what we may expect, and what varieties are really worthy of our atten-

tion, insuring good returns for the care and labors of the cultivator. It is fortunate for many of us that we have in our midst gentlemen of means and liberality who are ready and willing to purchase and test new varieties and give us the result of their experience to guide us in the selection for our gardens and farms. Many varieties which are extolled in the public journals, and lauded by circulars, although they may prove valuable in the localities were they originate, oftentimes disappoint the expectations and hopes of the cultivator in other sections of the country. By experience only can the real value of any variety for our locality be ascertained, and whoever plants the different kinds of vines that are constantly being brought out, must expect failure in many cases.

It must be admitted, notwithstanding numerous new varieties have been produced during the past ten years, that the Concord should be selected to-day, by the person who wishes to cultivate but one kind. Its returns are more certain, it is hardy and prolific, of good flavor, and generally sure to ripen. No other grape has been produced that combines all these necessary qualities in so great a degree, and is so well suited to our soil and climate.

Next to the Concord, we should select the delicious, beautiful Delaware, which needs but little more than an increased size of berry and cluster to make it the perfect grape so much desired by the horticulturist. Many of the varieties should be selected only by those who can furnish some favored, protected locality; among them may be named the Iona, a beautiful grape in color, size and flavor, but requiring a long season, and liable to blast and mildew. The same may be said of the Allen's Hybrid, Diana, Union Village, Maxatawny, Cuyahoga and Montgomery. The Adirondac is almost worthless in this locality, and the Creveling may also be considered a failure, growing poorer as the vine grows older. It would seem almost foolish to commence the cultivation of the Catawba or even of the Isabella in this vicinity.

The Garrigues is not so good as the Isabella, of which it is a seedling, neither is the Martha to be compared with the Concord, from which it sprung. The Dracut Amber and the Perkins, we believe, are not worth cultivating.

Of the new varieties which were exhibited this year for the

first time, we have great hopes for the Cottage, which has been brought forward by Mr. Bull, the originator of the Concord, who believes it, in some respects superior to that variety; the Rentz also promises well for the future, being quite early. At no previous exhibition of the Society, has so large a display of Rogers' Hybrids appeared, and these grapes attracted considerable attention from those interested in grape culture, because notwithstanding the number of years these varieties have been known, there still exists some diversity of opinion with regard to their value. Certain it is that the various numbers retain in a greater or less degree the foxy flavor and hard pulp of the native grape, yet some of them are excellent, and they have these advantages over many other varieties, that they are hardy, generally vigorous, giving fruit of large size, and are prolific bearers. Of the red varieties, we should judge No. 3 to be the earliest, although not of the best quality; in this respect it is excelled by Nos. 15, 22 and 28. In our estimation No. 28 is the best variety for this locality, it being both early and of good quality. Of the black varieties Nos. 4, 19, 40 and 44 would be selected as among the best; the two latter surpassing the others as far as flavor is concerned.

In concluding this Report your Committee would urge upon the members of this Society an increased attention to the culture of the grape, believing as they do that in some parts of our town it could be made a profitable crop. Every person who owns a few rods of land should plant a grape-vine. No branch of horticulture affords greater pleasure to the man who wishes to spend some of his leisure moments in his garden, than the cultivation of this delicious fruit. It requires a sufficient amount of care and judgment in its cultivation to make it interesting to the cultivator, who finds his reward in the beautiful clusters of health-giving fruit, gladdening the eye and cheering the heart.

L. STEPHENSON, Jr., *Chairman.*

WORCESTER WEST.

From the Report of the Committee.

PEARS.—The pears presented were less numerous in variety than the apples. The list embraced nearly all the kinds worthy of cultivation in this locality. The Bartlett, always at the head,

was very fine; but the Flemish Beauty, which cracked so last year that many trees were allowed to drop their fruit ungathered, was never finer or grown in greater perfection, fully redeeming its character. No pear-tree is more vigorous or better adapted to our soil. It is very productive, and was supposed to crack last year on account of the wet weather.

Clapp's Favorite has been fruited for the last three years in this locality, and it bids fair to take the lead. It began to drop its fruit the last day of August this year, and was in perfection the first week of September. It originated on the farm of Mr. Clapp, of Dorchester, and is said to be a cross between the Bartlett and Flemish Beauty, and is superior to either. The tree makes wood with great rapidity, and comes early into bearing. The fruit is large, melting, with a rich flavor, and very juicy.

The practice of dwarfing the pear by growing it on quince stocks, so extensively practised in France, so much advocated by some in this country, and so successfully carried on in and about Boston and on the seacoast generally, has met with but *partial success* in this immediate vicinity. And when we take into account the short life of the tree, the uncertainty of a crop, and the few varieties that have ever succeeded, after a thorough trial of more than a quarter of a century, we unhesitatingly pronounce the practice of growing the pear on any stock except its own a *signal failure*. We may be told that the Duchesse d'Angoulême, Glout Morceau and Urbaniste are greatly superior when grown on the quince. This may be true where the dwarf tree succeeds best; but in this locality, after repeated trials for thirty years, not a single specimen of the above named kinds has been produced in perfection. It has been said, too, that the Louise Bonne de Jersey is far less astringent when grown on the quince stock; but the fact is, that this valuable pear has been grown year by year for more than a quarter of a century, and perfected its fruit as a standard, while all attempts to fruit it as a dwarf have rendered it disagreeably astringent. There is but a single variety that has ever *really* succeeded as a dwarf,—the Vicar of Winkfield,—and the success in this case is dependent on setting the quince stock so low in the ground that roots may be sent off from the pear stock; but the pear is of inferior quality, only fit for cooking. The

chief argument in favor of dwarfing pears on the quince stock, is the early and immediate fruitfulness of the tree ; but most of our choice kinds—the Bartlett, Flemish Beauty and Rostiezer—bear too young for the good of the tree, and at this very hour fears are entertained that the Bartlett will soon fail and become extinct, because the bearing trees begin to show signs of decay ; but the tree has been allowed to bear fruit too young, and this is the chief cause of its decay. The Beurré Bosc, a slow grower, and does not come to fruit till the tree is ten or twelve years old, is in full vigor, and promises to be a long-lived tree, and one of the most approved kinds. Your Committee, therefore, would recommend the following kinds of pears to be grown always as standards : " First, summer pears—Beurré Giffard, Rostiezer, Dearborn's Seedling and Clapp's Favorite. Second, autumn pears—Bartlett, Flemish Beauty, Marie Louise, Beurré Bosc and d'Anjou, Sheldon, Seckel, Louise Bonne de Jersey and Buffum. Third, winter pears—Winter Nelis, Lawrence and Vicar of Winkfield. When the above kinds are well cultivated, any man will be abundantly rewarded with a rich supply of this invaluable fruit.

JOSHUA PORTER, *Chairman.*

WORCESTER NORTH.

From the Report of the Committee.

PEARS AND GRAPES.—The apple, which was formerly looked upon principally as a luxury, has become one of the indispensable comforts, if not indeed almost a necessity, of healthful existence. The pear and the grape have now taken the position that the apple once had as a luxury, and are fast approaching a position among the comforts of life that we can ill afford to be without.

This change in their relations brings with it a corresponding change in the manner of cultivation. Where formerly an almost bewildering number of varieties were coddled and nursed as pets, and coaxed to dole out a few specimens for our encouragement, we now devote our labors in such a way as to secure in much larger quantity, a product, which, without any material sacrifice in quality, can yet be afforded at a price which promises eventually to bring it within the means of the great body of the people.

We find, however, this apparent anomaly, that as the supply increases, the price advances, showing that the consumption increases at a greater rate than the production. This may not be at once evident if we compare any one year with that immediately preceding or succeeding, but by comparing seasons of greater interval, it will be found to hold true, notwithstanding the fluctuations in currency values. This being the fact, there need be no fear of an over-production. A very slight reduction in the price of a luxury, calls in an additional class of purchasers, and increases the consumption of those already existing, and the fact that the larger part of community have yet to taste, to say nothing of eating freely, of these fruits, places the time at which fruit-growing will cease to be a remunerative occupation, fairly out of sight.

Though this is true of the business when judiciously carried on, it is not true of all those that engage in it. While the growers in very many cases fail to get a new dollar for an old one, and their crops in some instances will not pay the cost of marketing, good fruit is yet not brought within the means of a large portion of the people.

This arises from various causes. The production of fruit is often embarked in merely as a means of making money, under the stimulus of occasional and unusual successes, without the requisite knowledge of the principles and practices essential to good results. It is as if one should, on the strength of a munificent price paid for some finished picture by a master, set himself up as an artist, and find that though his daubs were plenty enough, yet the price paid for pictures was tantalizingly high.

Fruit growing is an art, and a science as well. The art must be learned, and the science comprehended and understood if we are to successfully compete in the race. One of the greatest drawbacks to success has been found in the multiplicity of varieties under cultivation. While but a very few have been found to be uniformly successful in a commercial way, the time and efforts have been spent upon scores that were only a bill of expense to the owner from first to last. This is eminently true of the pear, and to a large extent also of the grape. The acquirement of this information has been a work of time, but the difficulty about it is, that almost no one is willing to accept such knowledge at second hand. Each one persists in gaining it

through a personal experience, which brings with it, in many cases, disgust and retirement from the pursuit. Almost any grower with an experience extending over a period of more than ten years, will say that the fewer the varieties, if well chosen, the greater and more valuable will be the product.

Among pears, after naming the Bartlett as standing at the head of the list for productiveness and profit combined, we shall be obliged to look in vain to find a second, which in a series of years promises to supplant it, and if we are asked to name half a dozen approaching it in these regards, we shall be apt, after consideration, to class the question among the unsolved conundrums. Among grapes, the Concord holds the same rank, only if possible, more emphatically.

To render fruit-growing a successful matter for the country at large, it must be made a success both to the producer and consumer. The one should get fairly remunerated for his efforts, while the other should be supplied with an abundance of fruit at a reasonable price. This can only be done by selecting those varieties for cultivation that yield large and uniform crops, even though their quality may not be quite equal to that of others whose single specimens are the apology for pecks or bushels. We should demand quantity as a first essential, and be ready to exchange only when we are sure of a gain in quality without loss in productiveness.

Another important obstacle in the way of success is to be found in the lack of knowledge among cultivators of the wants and requirements of their trees or vines; a knowledge that comes only from long and thoughtful experience and observation, and cannot be acquired from books or otherwise only in a partial degree. Dame Nature is apparently capricious. One day she will, and the next she won't. Now she promises to tell us a secret, and directly we find that she has not done it. She is ever talking in riddles, and just as we get ready to put our finger on a point we find that it has eluded our touch. The infinite variety of soils and conditions surrounding each plant, renders it extremely difficult—in most cases, impossible—to solve a problem of culture so that it will stay solved. The second experience contradicts the first, and the third is opposite to both.

There are, however, some general considerations that are not to be overlooked. A plant, like an animal, lives and grows by

what it feeds upon, and can yield compensating returns only when generously fed. The requirements of each tree or vine, in its particular situation and surroundings, should be carefully studied and made the subject of intelligent experiment. The empirical application of any manurial substance is to be avoided, unless in such a way as will insure a result meaning something. A great difficulty is, that when we put a question, we ask it in such a way that nature cannot answer it by a simple negative or affirmative. She is compelled to use circumlocution, and the answer is valueless, if it do not even mislead. The fault in such case is our own, and not hers. Compel her to say yes or no, and the answer is at once valuable. It is very common to hear cultivators allege, in cases where one occurrence follows another, that the first must be the cause and the second the effect. If, for instance, a particular tree has not blossomed for some years, and, following an application of some kind during the winter, it shows a full bloom, it is at once concluded that the application was the cause of the blossoming. A very little knowledge of the matter in which fruit buds are formed and matured during the previous season, would prevent the exposure of such ignorance. It is as ridiculous as was the annually repeated assertion of an old gentleman who was a confirmed invalid, that he had always noticed that if he could manage to live through the month of March, he did not die that year.

It is very satisfactory to notice, from year to year, the manifest improvement that is exhibited in our display of fruits. Worthless and inferior varieties gradually disappear, and the collection grows more choice and select. It is getting to be understood that it requires no more labor or skill to produce only the desirable varieties, and in fact less of either, if the less be accompanied by increased knowledge how to begin.

The writer has often taken the first premium for a display of the largest number of varieties of pears. Although he enjoyed the victory, he would dissuade others from attempting it, and it is doubtful if the society should encourage it. If any one thing has tended to dishearten the cultivator and drive him from the pursuit, it is the failure arising from wasted time and money spent over a large number of varieties. As a matter of personal satisfaction it may answer, but the public can never be

supplied with fruit in this way, and it requires a vast amount of enthusiasm to follow it up for a very great length of time.

It is highly desirable that competitors should take a little more pains in arranging their fruits for premium. The rules are plain, simple and easily understood; but, for some reason, little or no attention is paid to them by many exhibitors, and then complaint is made that the committees are incompetent, unfair and partial in making up their awards. If a rule requires twelve specimens to compete for a particular premium, plates will be found with from eleven to half a bushel, the competitor seeming to think that half a bushel is certainly twelve, and that the committee can discard the surplus, which they have no right to do. Mr. Heath's Delaware grapes, for instance, were very fine, and had he arranged his best six clusters as the rule specified, he would, without doubt, have taken the first premium; and so in a number of other cases.

Premiums ought to be offered for specific things, because they are desirable and worthy of encouragement. If a premium is not offered for any particular display, the inference should be, unless it is something new, that the society do not care to encourage it. The mere piling up of bushels of fruit does not make an instructive or even interesting exhibition. The society might, perhaps, extend its offers so as to cover more ground, and then allow but a very small amount for gratuities.

JABEZ FISHER, *Chairman.*

CRANBERRY MEADOWS.

MARSHFIELD.

From the Report of the Committee.

Your Committee on the Preparation of Cranberry Meadows have attended to the duty assigned them, by visiting the meadows of those who have made entries, the premiums for which are to be awarded in the years of 1871 and 1872. The names of those persons who have made entries are as follows: Martin Bryant, of Pembroke; John Harlow, of Marshfield; Gifford &

Loring, of Duxbury; I. H. Sherman, of Scituate. Thus far they have made a fair progress in the preparation of their meadows, and it is desirable that they follow up their industrial pursuit in such a manner as to reap a rich reward for their labor. They have all chosen good locations, viz., peat-bottomed land, which is very desirable, most of them well sheltered by woods and trees or bushes, which in a great measure protect them from the cold northerly and westerly winds. Such locations ought to be highly appreciated by the cranberry-growers. By taking a survey through the towns of Massachusetts, you will sometimes come in contact with swamps surrounded by sand-hills. Such locations as these are also very desirable, as sand is very useful and important for a top-dressing for cranberry land. Our opinion is, that the cranberry vines should be flooded as soon as the first of November, to such a depth as to prevent the water freezing among the vines, and pulling them out of the surface, and also that the vines may retain the sap, which the frost would otherwise take out by freezing. Flowing is also desirable, to prevent the ravages of the cranberry-worm; for the meadows which are flowed through the winter are not half so likely to be attacked by them. This worm is of small size, smaller than the apple-worm, although similar in appearance. It makes its appearance about the time the berry begins to ripen, by eating a hole through the outside and coming out. The berries are then rendered worthless. It is our opinion that the worm originates in the blossom by a white miller, which lays an egg there; then, when the cranberry is about to grow, the worm is also grown, and it eats out of the berry, and, we suppose, remains in some form about the meadow, and in the spring turns into a miller, and the berries are again destroyed in the same way; and it is on this account that flowing through the winter is beneficial, as it is very likely to kill most of the worms. The water should be kept on until about the first of June, for keeping it on until that time prevents the vines from vegetating, as the early frosts would be likely to destroy the new shoot, which is very sensitive. The cranberry never grows directly on the old vine, but always on the new shoot, which starts from the old vine. If the shoots are struck with frost in the spring, we are sure to have no berries that season. After letting the water off, care should be taken not to have any stagnant water in or about the cranberry

lots, as it always injures the vines and berries. Another desirable place for cultivating cranberries, is where a reservoir can be made above the lot, so as to flow it at any time and in about two hours; and, if desirable, be able to let it off in about the same time. If we watch the thermometer, and let the water on when there are any indications of a frost, we shall in that way save the berries, when otherwise they would be destroyed. It requires skill and judgment, however, to know how long to keep the water on, in the different stages of the growth of vine and berry. If it is in warm weather, do not keep the water on long enough to soften the berries, so the hot sun will destroy them. It is impossible for us to lay down any rule; skill and judgment must guide us in a great measure. Let us, the members of the Marshfield Agricultural Society, try to enlarge each others' knowledge in regard to husbandry of all kinds, for we are all aware that agriculture forms the most permanent riches of a nation, for we can eat neither golden bread nor golden butter.

ISRAEL H. SHERMAN, *Chairman.*

FARM IMPLEMENTS.

WORCESTER NORTH.

From the Report of the Committee.

The Committee on "Farm Implements" would report: That having first examined the list of implements for which premiums were offered, we found there was no prize to be awarded to the first and most important one now in use; to wit, the plough. Although improvements, within the last few years, have been made in this department, yet we have seen nothing at our "ploughing exhibitions" that supersedes, for good work, that of the "old double Michigan." Now that still greater improvements should be made in this as well as in all other farming utensils, greater inducements should be offered by way of prizes, and the Committee should judge of their merits or demerits by the *work* they are capable of doing. No man or committee can properly deal out justice even-handed without a fair trial of

them in the field. We fear that the practice already adopted of awarding prizes for farm implements without trial, may lead to unsatisfactory results, to the inventor as well as the consumer.

The swivel plough is fast coming into use, but no faster than necessity demands. We believe that all lands should be ploughed without leaving those unsightly dead furrows and huge ridges upon them.

We would therefore recommend that prizes be offered for ploughs that will perform the best work.

The question may be asked, Why do we plough ? This question being answered, we get a clue to the science of the work.

The first object in ploughing is to pulverize the soil, and make a deep, mellow seed-bed, capable of absorbing from the atmosphere those gases necessary for the growth and life of plants. The absorbing power of the soil is better understood than formerly, and the power depends very much on the fineness of the particles. It is well known that if water, adulterated with barn manure, be strained through fine clay, it becomes partially pure ; if loam be used, it is less so ; if filtered through gravel or sand, the change is hardly perceptible ; proving that the water diminishes in purity in proportion to the porosity of the soil—sand a poor absorbent. Hence, if we wish our soils to retain the manure we put upon them, and absorb from the atmosphere the rains and dews, it is all-important that we well pulverize our soils and make them porous. Clay is said to have more absorbing power than sand, not because of the affinity that exists between clay and ammonia, but because the particles of dry clay are exceedingly fine, and the ammonia is retained by them. Although pulverization is not a complete substitute for manure, yet it materially aids the young rootlets in making their researches, and hastening the crop.

One object, then, in ploughing, is to turn the sod or stubble so that the air and rains may penetrate the soils and deposit their fertilizing influences. In ploughing sod ground, two opinions seem to prevail. The first, that the furrow-slice should be cut and laid independent by itself, and the whole field thus ploughed should present a smooth, flat surface. Doubtless this method is preferable, if we intend to stock the field down to grass, either with or without small grain, as it then becomes an easy matter, with a cultivating harrow, to

make a level, smooth field, fit for the mowing-machine the next season. But in case the field is to be cultivated in some hoed crop, we prefer that the furrows should be somewhat shaken up, and lap a little upon each other, and their relations to a certain extent disturbed.

It will be found that the sod thus broken by the plough will much more readily yield to the harrow than the field that presents the smooth and even surface; and if it contains a large amount of clay, it soon becomes dry and hard, through the influence of solar heat, and is not easily pulverized. We know of no plough so well adapted for pulverizing the soil as that already alluded to. It requires a strong team before it and an expert behind it; but what is lost in the muscle of the animals is gained in the crop that follows.

Another object in ploughing is to mix the soils. It frequently happens that the surface soil is sand, and the subsoil clay, or the surface abounds in vegetable matter and the subsoil wanting. Now it is all-important that these soils are mixed and reduced to a proper fineness before they are fit to give a strong growth to the virgin plant; and the plough that accomplishes this work in the most effective and thorough manner, other things being equal, should be preferred. And how can the merits of it be determined, except by actual trial?

Another object in ploughing, is to increase the depth of soil, that the roots of the plants may have a more extensive range. Formerly it was supposed that the roots of all cereals extended only a few inches; but within a few years it has been proved beyond doubt that they extend several feet. These facts go to show that shallow ploughing is all wrong.

We would not, by the way, recommend to plough up a large amount of subsoil that never before had been removed, but at each successive ploughing gauge the plough so that it may remove about one inch more in depth than at the previous ploughing. This will add an amount of subsoil to the surface equal to about one hundred loads, of thirty bushels each, to the acre, to be converted into surface soil. This method should be practised till the required depth is obtained.

Mowing-Machines.—The first farm implement that came to our notice for which a premium was offered was the "horse-mower." Only two entries were made. The probable reason

for so meagre a show in this department, was in consequence of the small amount of premiums offered, viz., $10, whereas it should have been at least $40. If our grass fields are to be cut by horse-power, our agricultural societies should be more liberal in offering premiums, that we may have greater competition and bring out the best machines. Manifestly the horse-mower is the greatest labor-saving machine to the farmer that has yet "been got up." It was the prevailing opinion, less than eight years ago, that there was not brain enough in New England to get up a mowing-machine of one horse power worthy the name of a horse-mower. Yet at the present time there are probably more one-horse machines used in Worcester North than of the other kind. Of the two machines entered,—the Buckeye and Clipper,—we have to say that the Committee were not unanimous in awarding the premium.

About four years ago, these two machines were exhibited in the field, before a committee, for their *preference.* Hence the general movement of the machines was critically examined, and after the hay had been removed, the committee again examined the field and were not unanimous. This committee was composed of one professional gentleman and four practical farmers, each of whom was the owner of a horse-mower; yet they were equally divided in giving their preference. The chairman, not being a practical farmer, declined giving an opinion. One member of the present Committee was also a member of the committee in the field where the machines were exhibited and had a fair trial. Hence, from the experience we have had in using horse-mowers, we are satisfied that the good work done is not all in the machine; that it requires a good team before it, and a man of judgment and common sense behind it. Now we have simply to say, that we have seen just as good work done by the Clipper as by the Buckeye, and by the Wood machine as either; and Joseph Marshall, of North Leominster, performs first-rate work with the Union, while Solon Carter, with the "old Manny," will do as good work as the next man with *any* machine.

Horse-Rakes.—As this farm implement has for so long a time been used in this section, it is hardly necessary to speak of its merits. Those who have used the old wooden revolver, very well known that one acre can be raked in less than an hour.

Therefore, no farmer that owns a horse has a right to rake his hay by hand and let his horse stand in the stable or run in the pasture. And no farmer that cuts hay sufficient for twenty head of cattle and a horse, can afford to be without one of the improved rakes mounted upon wheels; it is a great labor-saving machine and *should* be in the hands of *every* practical farmer.

Now as hay is the principal crop raised in New England, every farmer should be well armed with such farm implements as have been invented, and still greater inducements should be given that greater improvements may be made. It is well known that a farmer cannot afford, at the present high prices of poor labor, to harvest his hay crop with manual labor alone; hence horse power *must* come in. Moreover, we believe it morally *wrong* for men to undertake to do that kind of work that can so easily be done by horses.

We believe that the great reason why farmers' boys are so anxious to leave the farm and go in pursuit of other business is in consequence of so much drudgery and hard work. The bone and muscle are too much exercised and the mind too much chained and narrowed down. Every farmer should endeavor to give his boys a good common school education, at least, and if his means are adequate to go beyond this, all the better. Why should not the boy who intends to become a farmer, be as well educated as though intended for mercantile or any other pursuit? Boys should be taught in the school-room as well as at home, that farming is healthy and honorable and independent, not low and degrading.

But agriculture has not kept pace with other pursuits in making improvements. It is not a science by itself, but connected with other sciences, and the farmers have yet much to learn in the matter of reclaiming waste lands—the cultivation of fruit trees—the rotation of crops—the application of manures and fertilizers—field drainage, &c.

E. GRAHAM, *for the Committee.*

STOCK.

MIDDLESEX.

Herds of Cattle.

In the term as here used, these are not chance selections in the market—such are the "stock" of farmers. But a herd implies breeding, and breeding with a purpose, pursued with all his skill to meet the wants or the taste of the owner. This requires, too, a fondness for the herd—for without a strong liking for the breed or grade selected, they will not get the thought and care necessary for success. With this love, it makes little diffierence what kind are chosen; any kind will be good, and prove the better for the attention they receive. With a herd so raised, the owner takes pride in having his name associated; he values them higher than their market price; he parts with them reluctantly, and only when they bring all he asks, and are reasonably sure of good treatment. Of them, he makes the most his care and skill can accomplish, and the results to him are much more profitable, than to another with the same animals, only without the strong liking for them. It was sound advice to a retired merchant, stocking his newly purchased farm, to buy and breed that kind of animals for which he had a decided taste; and if he was indifferent, to consult the likes of his foreman. It is good advice to every farmer to keep that breed or grade of cows he fancies most, and if he does not fancy any, not to keep cows, or to try to create a grade that will suit him. Altogether too little attention is paid in this milk-raising county to breeding calves and raising cows. Bad habits, disease, abortion, are the drawbacks that follow the unnatural and wasteful method that is commonly pursued. If every promising heifer calf were raised, the worst of these troubles would soon disappear, and the stock of milch cows would be greatly improved. Hay tea, and reasonable allowances of shorts and other grain the first season, good rowen and pasturage the second, diminish but very little the supply of milk, and secure a supply of cows. Care in the selection of the stock bred from, and care in the raising, are the chief requisites; and this care costs but little in money, and produces much. Thoroughbred stock, if not within

the reach of all, is so widely distributed that good grades are easily obtained, and if there is a limit to the improvement that may be thus effected, it has not yet been reached. Much has already been done, but even more remains to do, and successful experiments in judicious crossings will amply repay all who make them. This is the way, and the only way, we shall ever obtain a stock suited to the wants and conditions of our farms, and every farmer who can, should do his part toward it.

The Committee to award the herd premiums, met and received the statements of the competitors on the first day of the exhibition. Proceeding to the pens, they found two herds of Jerseys, one belonging to Francis B. Hayes, of Lexington, the other to N. Foster, Jr., of Belmont; one herd of Ayrshires, the property of George M. Barrett, of Concord, and two herds of natives and grades, one owned by Mr. Barrett, the other by Webster Smith, of Lexington.

Mr. Hayes's herd had previously taken the first premium, and were entered only for exhibition. They are very superior animals, and fine specimens of the breed. The more recent importations would seem to indicate that we can breed Jerseys here as well as in the Channel Islands, or at least that the later importations are not improvements on the earlier. Certainly the portion of this herd bred here, would be preferred to the new arrivals, and as this has become so common, it tends to show that we are really improving the breed, and adapting it to our condition and wants.

The herd of Mr. Foster were finely marked, and evidently carefully and judiciously bred. The old cow, "Buttercup, No. 4," has been one of the best Jerseys in this county, and Mr. Foster, in securing such an animal, has laid the foundation for a herd that will have great excellence. The younger animals show the results of good breeding, and the promise of becoming even better stock than their progenitors. Although his statements were deficient in some of the particulars required in this class, there were so many good points about the herd, and it was so evidently within the design and object of the society's premiums, of which more will be said farther on, that the Committee had no hesitation in awarding him the premium.

Of the Ayrshire herd, we need only say that it fully kept up the reputation of Mr. Barrett as a breeder, and would have de-

lighted the eyes of a milk *raiser*. Of its effect on a milk *consumer*, we cannot speak so confidently, as we had no opportunity of testing the quality of the milk. The percentage of cream given by the lactometer at the end of milking, would not afford much indication of the character of the milk when it reached the consumer, and many cans of the "eighteen per cent. cream," would be a fortune to a dealer in milk, if it did not "make fat the eater." The Committee awarded Mr. Barrett the premium on Ayrshires.

In deciding between the two native or grade herds, we were chiefly influenced by the fact that Mr. Smith's herd were bred by him, and wholly of grade Ayrshire and Durham. This seems to us the real object of the society's offer of a premium. It never could have been intended that a cattle dealer, who by skilful purchase or lucky trade, should get together half a dozen cows of any or all breeds, or select that number from his stock, and keeping the measurement of their highest flow, take this herd premium simply because he happens to own the six best cows shown together at the exhibition. This would furnish no information as to their breeding, and would only indicate the luck or skill of the owner in his trade. The premium alone would pay quite a percentage on the investment, and the utility to the society or the community would be doubtful. We presume it was intended to induce experiments in raising a breed or grade of cows adapted to the wants of the owner—and by the successful results of these to furnish an example for others to follow, or improve upon. Such a herd have a value both to the owner and to the agricultural community, far beyond the chance selection in the markets of equally good cows, as the character and qualities of the herd can be perpetuated or improved, and such a herd alone really deserves the premium. Acting on this idea, we awarded the premium to Mr. Smith's herd, even if the statements of the milk produced and the percentage of cream made by his competitor did indicate a better result. Mr. Smith's cows looked finely, and were a stock of which any farmer might well be proud, especially when they had all been bred on his farm, and he had good reason to believe he could increase their number and their good qualities as occasion might require.

J. S. Keyes, *Chairman.*

From the Report of the Committee on Grades.

Your Committee are of the opinion that much good will result to the agricultural interest by these experiments in crossing some of the various breeds of stock, by producing a change in certain peculiarities of form and condition. This your Committee noticed especially in the crossing of the Dutch with the Jersey, resulting in a thinner skin and a finer limb than can be found in the pure Dutch; and the cross of the Jersey with the Dutch produced a fuller proportion of quarter, a rounder form of trunk, and a hardier general appearance than is seen in the pure Jersey; and we think that these experiments in crossing may be profitably extended to other breeds, so that objections in the form of the one may be overbalanced by an opposite excellence in the other. So long as like produces like, so long we may go on with these experiments with pleasure and profit, by gradually but surely bringing about greater perfection of form, and at the same time increasing the products of our dairy, by mingling elements that will surely produce better quality with greater quantity. The dairy interest promises to be the great interest of our Middlesex farmers, and the rearing of the choicest animals, with reference to the best results in this direction, is now consistent with our interest, our duty and our pleasure. And your Committee feel that the constant and untiring efforts of the donor of the special premiums offered, under which we have made the above awards, in improving the stock of our farm animals of this county and State, are having a decided effect, visible not only on our annual exhibition days, but apparent also wherever in this vicinity business or pleasure leads us. The *scrubby stock* is visibly disappearing, being supplanted by that which is more pleasing to the eye and more profitable to the purse. May our numbers be increased from year to year by public-spirited gentlemen of affluence, who will coöperate with him and this society in developing to a still greater degree *profitable stock raising and profitable farming*.

Charles A. Cutting, *Chairman.*

WORCESTER.

From the Report of the Committee.

Working Oxen.—It is impossible to make good, strong oxen of steers that are starved a portion of the year, or left to care

for themselves as best they may during the cold season, however full they may be fed the other portions of the year. Such cattle may perhaps be made to grow to a decent size, but the compactness and muscle which ought to have been attained during their "starving time" can never be regained, however highly they may be fed and nourished afterwards. Neither can oxen grown up suddenly, after being grossly neglected while young, ever attain that endurance for hard, continuous labor as those that are kept constantly growing, and, without being pampered, are always in a thriving, healthy condition. Many an ox has been spoiled for the work he ought to be able to do, by starving over poor hay during the winter, and standing in the cold and sleet while young, instead of being fairly fed and comfortably housed.

It is well understood by every intelligent farmer that it *does not pay* to starve or freeze heifers, if he desires to make good milch cows of them, or to keep sheep on brush if he expects to get healthy lambs and a good fleece. So he who desires a good pair of oxen will find that all neglect of proper feeding and shelter, and all abuse of them while young, will depreciate their value when grown to working oxen just in proportion to these abuses. It does not pay as well to half raise stock as it does to feed and shelter them as the best good of the animal requires, saying nothing about the moral guilt that attaches itself to all such wrong doing. Many of the objections which men have to using oxen on their farms would doubtless disappear if they had proper care when young.

In most instances, the oxen at the trial were under good discipline, and performed their work in such a manner as to show that they had been carefully trained, and with a good degree of gentleness. Before an ox can do what is required of him, he must first be taught *what it is, and how to do it.* Whipping does not do this; it only irritates and renders him less willing to learn. If the driver will carefully and *patiently* show his oxen what he wants them to do, he will find but little use for the whip afterwards.

The Committee could but notice one fact at the trial, viz.: those teams did the best where the whip was used the least. The oxen that took the first premium were hardly struck during the time of trial. If other teamsters had been equally careful

in that respect, their oxen might possibly have performed their part so well as to have made the awards different.

AUGUSTUS J. SAWYER, *Chairman.*

WORCESTER WEST.

From the Report of the Committee on Bulls.

Your Committee are of the opinion that "bulls two years old and upwards" are far less numerous than they should be, not only at our agricultural fairs, but throughout the community on our farms.

It is the prevailing opinion, and we think a correct one, that heifers are not as desirable to breed from as mature cows; and that a cow's value as a breeder does not abate till old age begins to tell upon her constitution. Why does not the same principle apply to bulls? Is it not reasonable that a mature animal will reproduce more vigorous stock than one that has not arrived at maturity? The principal reasons why most bulls are disposed of at two years of age, are, first, they cease to be sure getters; and, second, they are liable to become vicious and troublesome. We do not wonder that the first reason named so often exists. Bulls are usually put to service at one year old, and often serve forty or fifty cows during the first season, and, as a consequence, their subsequent value for stock is quite uncertain. If bulls were limited to twelve or fifteen cows the first season, and to twenty-five or thirty the second season, we think there would be as little cause of complaint of the sterility of a three years old bull as of a yearling. There is little necessity of bulls becoming dangerous if they are treated with uniform gentleness and firmness, especially if they are broken to the yoke, as they should be, when quite young.

M. O. AYRES, *Chairman.*

From the Report of the Committee.

THOROUGHBRED DAIRY COWS.—Your Chairman wishes to ask some questions, and make a few suggestions. The questions here presented themselves somewhat as follows: First, For what purpose do agricultural societies offer premiums? Second, Does the offer of premiums by this society for thoroughbred dairy cows attain all that is desired? In regard to the first

question, we believe they offer premiums for the purpose of encouraging the public to breed and raise the best stock and crops, and to elicit all information beneficial to agriculture. The State bestows upon this society six hundred dollars yearly, and it is evident that we, as a society, are under an obligation to the State for its bounty. We should show to the State that its money has been judiciously offered and paid in premiums, and that it has elicited information of much value to agriculture; and this can be shown only by our printed Transactions. If our Transactions contain only the awards of premiums, they are of no consequence to any one except those interested as competitors. This leanness of the reports of the different committees is not wholly the fault of the society; perhaps it is more the fault of the committees themselves. Each committee has a portion of the State's bounty to award, and should give the reasons for their decisions, in every instance, where the case will admit of it; for of what value is it to the community to know that B's animal or article took the first premium, and C's the second?

The second question, we believe, must be answered in the negative. The society requires the competing animals to be on the ground, ostensibly that the public may view them; but, at the same time, it requires nothing of their owners except to tell who their cows' ancestors were. If an exhibition of "thorough-bred dairy cows" is worth anything, its value lies in its power to instruct those who witness it. Now, so far as imparting any information to the public is concerned, the public might as well have looked at pictures as at the cows.

But at whose door does the fault lie? Not the competitors', (as they answered all the requirements,) but the society's. A cow that would not give milk enough to keep her calf in good growing condition, might, if her pedigree could be traced back to some very popular animals in their day, in the kingdom of Great Britain, get the preference over another nearly as perfect, and very much superior in point of dairy qualities. If a dairy cow has any value as such, she should not put forward her pedigree as the only answer, when we ask what quantity of milk she gives, or how much butter or cheese she can produce. Now to obviate these objections, we would suggest to the trustees to require competitors to make a trial of their cows, at a time to

be designated, and to file with the secretary a written statement of their produce at such trial; also the manner and expense of keeping. We would also suggest, that, for the benefit of the public, copies of the statements should be posted upon the pens where the animals are.

And now for the reasons which influenced *us* in making the recommendations of award. As the society requires nothing of competitors except to furnish a pedigree of each of their animals in this class, we had nothing else to guide us except outward appearances, which are not always reliable.

The writer of this Report believes there would be just as much propriety in awarding premiums on work-horses or oxen, without a trial with a load, as there is in awarding premiums on dairy cows, without knowing either the amount or quality of their milk.

J. P. REED, *Chairman.*

From the Report of the Committee.

FAT OXEN.—If there is any one class of cattle more than another, that adds to the attractiveness of an agricultural exhibition, and makes it really a "feast of fat things," it is the presence of a large number of fat oxen. There is an old time saying, that "bread is the staff of life." Your Committee think beef is a very good support to lean upon. If the statistics of the number of cattle slaughtered in any one year, were here presented, the question, that beef is only second to bread, would be fully sustained. And another question, from whence comes all this great number, would be as readily replied to, from "the cattle upon a thousand hills." Suppose we look into this matter of beef a little, and see how much of it would really bear the description which the fruit culturist gives his fruit: "Flesh tender, juicy, rich, sweet and almost buttery."

In regard to the production of beef, very much of it hardly deserves the name. Oxen that have been worn out with labor, poorly fed, muzzled when "treading out the corn," kept till their bones are like pillars of brass, and their sinews cables for shipping; cows kept for dairy purposes till their systems are all worn out and exhausted; these two classes of cattle are put in pasture or stall and fattened for market; and the result is, your nice beefsteak, which you aim to get, has to go through a

pounding process, said to be for the purpose of making it tender, though in case of the laboring ox, in many instances, that was done beforehand, resulting, perhaps, in either case, in not having juicy and tender beef; and the boiling of your corned beef, the cook complains that it is all "shrunk up," and all, of course, because the slaughtering was done at the "wrong time of the moon." Occasionally some choice calf is reared for the purpose of getting the most growth and making the finest beef, and when slaughtered it is made the scape-goat for a half dozen poorer ones, resulting in no credit to the best fattened beef. One very essential thing for making the finest quality of beef, is the keeping of it in such a manner as to make continuous growth, without having at some seasons of the year loss from poor feeding or inattention and care.

Take, for instance, two steer calves of good form and size, grade Durham, if you please, put them upon a good cow, let them have the use of her the first summer, then feed in winter upon early cut hay, some roots and a little meal, give good pasture the second summer, and so continue till three or four years old, and see if you have not beef of a quality equal to any here described.

This manner of growing beef will be objected to by some as too expensive. Can you have anything of a superior quality, without care, labor, and expense? And as regards profit, we believe there is more of that, and certainly much more pleasure will be derived in this way, than skimmed milk and meadow hay. Farmers are too careful about present profits in the rearing of good oxen for beef as compared with future rewards.

E. C. Farnsworth, *Chairman.*

WORCESTER NORTH.

From the Report of the Committee on Thoroughbred Stock.

Your Committee having made its awards, cannot forbear some remarks growing out of the occasion of its coming together. Its members were felicitously chosen for the impartial performance of its duties, four of them being non-residents of the county, and one of them being a breeder of Shorthorn or Durham stock; another of Ayrshires, and another of Jerseys, and strangers to the particular stock exhibited at Fitchburg. The arrangements

for the examination of the stock cannot be too highly commended, differing, as they did, from most of those at our county fairs, and allowing the Committee to pursue their labors without molestation, and without the necessity of hunting on the field for the cattle desired. We were very agreeably surprised by the show of Shorthorns and Ayrshires, owned in Fitchburg, and could hardly realize that amid the incessant toil and watchfulness consequent upon the employments of so prosperous a manufacturing community, sufficient attention could be given to the raising up of such noble herds.

It was the remark of one (General Washington,) who seldom said an unconsidered thing, that in the multiplication of animals the greatest blessing was being conferred upon the country, so far as its material prosperity was affected. Many of our amateur farmers are coinciding in this view, and, of late years, great attention has been paid to the breeding of pure stock, and the most noted breeds—those which find higher favor among us—the Shorthorns, the Ayrshires, and the Jerseys have attained great prominence in New England. It is claimed by the adherents of each class that *it* alone is more especially adapted to our wants; but, as Uncle Toby said to the fly, " the world is large enough for all," and their merits are so *sui generis*, that neither breed should conflict with the other. The Ayrshires are especially valuable when milk alone is desired, and the pastures are rough and short; the Jerseys, where butter is the main consideration, and on the gentleman's lawn; the Shorthorns, as a general farming stock, and in localities where, in addition to a fair allowance of milk and quantity of butter, carcass is needed for working cattle and for beef. We need not fear being overstocked with too many good animals of either kind, and the industry of careful breeders will be severely taxed to meet the wants of the more intelligent farmers, and fill up the voids arising from the neglect of the less intelligent, who purchase fine stock and fail to take proper care of it.

The Shorthorn cattle, as is now well known, came from the original stock, brought into England by the Danes prior to the Norman conquest, and were improvements made by careful breeding, commencing about the year 1780. Importations came to this country as early as 1815, and into Massachusetts in 1818, and the fine milking stock, now so prominent throughout New

England, is owing to the efforts of breeders yet living in our State and those contiguous to it. The successful efforts of the Messrs. Lathrop, of South Hadley Falls, Mass., and Benjamin Sumner, of Woodstock, Connecticut, to breed this fine stock to flesh and milk are worthy of the highest commendation, and we see, with pleasure, that Mr. Whitman, of Fitchburg, whose fine herd of over fifty head came under our consideration, is vieing with other good breeders to restore to our Shorthorns their milking qualities, of which, by continuous breeding for beef purposes they have, in a measure, been despoiled.

The origin of the Ayrshire cow is even yet a matter of dispute, but is comparatively recent, as writers on cattle, not long previous to the beginning of the present century, do not mention the Ayrshire as one of the recognized breeds of Scotland, but they undoubtedly arose from an admixture of the native cattle with some improved breeds. Tradition refers to an early importation of Alderneys to the parish of Dunlop, which first became distinguished for its cows and produce of its dairy, and tradition appears to be confirmed in the minds of some, by what is considered a similarity between the Alderney breed and the modern Ayrshire ; but more recent criticism leads to the conclusion that the improvements in the Ayrshire stock were effected by a cross with compact Shorthorn bulls, descended from good milking families, and from this cross came the shape, color, and milking qualities of the modern Ayrshire cow. They first began to be imported here in 1831, and have not lost by contact with our climate in stamina and form, though probably they do not yield as much milk as in the moister air of Scotland. The best importations have been into Massachusetts, none exceeding those of Mr. Cushing, of Watertown, near Boston, prior to 1837 ; and the herd of Mr. Birnie, of Springfield, has disseminated its progeny all over the country, and stands, at present, unrivalled for excellence. We are glad to see the fine herd of Capt. Miles, at Fitchburg, and among it animals second to none in the country.

The Alderneys—or as they are now designated, the Jerseys—though a recent favorite among us, are an old importation into England—are mentioned incidentally in volumes of the last century, and have been brought to this country by captains of vessels, for use on the voyage, for more than thirty years. This breed is derived from the group of beautiful islands pertaining

to the British crown, which lie near the shores of France, in the bay formed by the coasts of Normandy and Brittany. The islands are four: Alderney, Jersey, Guernsey, and Sark; and from the largest and richest (Jersey,) our more recent importations have arrived; and, as by a law of that island, no cow, heifer, calf, or bull can be taken into it from elsewhere, the indigenous breed must be pure. The breed of Guernsey differs from the others, having more spreading horns, size of the animal larger, form rounder, and bones less prominent, and the whole carcass coarser, and presenting but few of the peculiarities of the graceful Alderney or Jersey cow. As is well known, these cows are now great favorites, are increasing in numbers, and sell for good prices, and estimated as well for their diminutive size, and deer-like head, body, and limbs, as for their richness of butter. The late John A. Tainter, of Hartford, Ct., as early as 1850, made the first large importations, and their descendants have always been highly esteemed; but in all probability the finest animals of this breed in the world are now owned in the eastern part of Massachusetts. The herd of Mr. Brooks, of Princeton, was well represented at Fitchburg, and there were several other fine animals belonging to other owners.

It is not necessary for us to refer to the Devons, another favorite in special localities; nor to the Holsteins, now coming into notice, through the exertions of Mr. Chenery, of Belmont, as they were not represented on this occasion.

Perhaps we have dwelt too long on the subject of improved stock; but when it is considered that in England, by improved breeding, the capital of the country invested in bovine stock has increased in value twofold during the present century, merely by the earlier maturity of the young intended for beef—a steer or heifer weighing as much now at two years as formerly at four—the two years' feeding being thus saved, among other considerations—and that we have an aggregate value of nearly *one thousand millions* of dollars invested in neat cattle of all descriptions, in this country, we can but think no employment is more worthy of the men of resources and taste, than the caring for and the improvement of our stock; and we rejoice in the activity of the thousand and more agricultural associations throughout the land—owing their origin to the Berkshire system, introduced by Elkanah Watson, in Pittsfield, in 1810—by

which the competitors in growing the best stock of all kinds are so generously fostered. If all these associations are as well managed, and present as good a show as that at Fitchburg, we are on the high road to great results, not only in improved stock, but improved farming.

R. Goodman, *Chairman.*

HIGHLAND.

From the Report of the Committee on Calves.

In rearing and buying calves, the best will always pay the best; but it will not always pay to sell the best. There is an old adage, that "blood *will* tell." Then know that the blood of the dam is what you want; that she has never been served by anything except the blood you wish to perpetuate. Once served by impure blood endangers all future progeny. Whatever the dam and sire may be, no progeny can be said to be strictly thoroughbred if the dam has ever been served by an impure animal. Cultivate those qualities you wish to perpetuate, remembering that "like begets like."

Breeding-animals should be treated with the utmost kindness. Avoid all irritation, excitement or fear. The mental condition of dam and sire, and the continued mental condition of the dam during pregnancy, (if the word mental may be applied to brutes,) has very much to do with fixing the temperament of the offspring, and may influence the physical conformation. Having used every precaution, that your calf has come into the world under the most favorable circumstances, it should receive constantly uniform attention; not overfed, but a generous amount of feed should be regularly given, and at stated times. A variation of half an hour in time of feeding will cause one-half hour of uneasiness and wasting of flesh. Let the feed be of such quality and amount that the animal will be kept constantly thriving. An animal that is growing to-day will be more likely to grow to-morrow. Every day that an animal is kept without growth is so much loss in feed, time and care. Any shortening of feed, so that the growth is checked, is a loss for that day, and may be a loss for days to come, as an animal that is stationary, without growth, may take time to get again in growing condition.

The best animals always find the most ready sale, and at the best prices. A growth of one pound per day, until three years old, will give an animal weighing about 1,150 pounds. If the growth be one and one-half pounds per day, the weight will be about 1,700 pounds. With the price of neat stock at eight cents per pound, live weight, a growth of one pound per day will give eight cents; of one and one-half pounds per day, twelve cents; and if stock is so kept that there is no growth, then the time, care and cost is an entire loss.

Within the limits of this society there is a very considerable portion of young stock so kept from fall to spring that there is no increase of weight; consequently the entire winter feed and care is a total loss. This should never be; and the remedy is, early-cut hay, warm shelter, convenient water, and regularity of feed and drink. We think no farmer can fail to see the difference, pecuniarily, between twelve cents per day and nothing.

C. O. Perkins, *Chairman.*

BRISTOL.

From the Report of the Committee.

God, in his wise providence, gave to mankind the cow, one of the best gifts to the human family. We, by the aid of our housewives, receive a great many luxuries from this noble animal. The flowing pail of pure milk, in which are dainties supplied for the rich and food for the poor, which is both healthy and delicious; rich cream, excellent cheese and the rolls of golden butter are a few of these dainties of which we should not be willing to be deprived. Her products are carried wherever civilized man goes. How surely she pays for every blade of grass, lock of hay and kernel of corn with her daily contributions; and all she asks in return is enough to eat and drink, and that to be of good quality. In Eastern lands, the good "shepherds watch their flocks by night," and remain with them during the day, seeking for the most fertile spots. Joseph's brethren went to Dothan for better pastures, for Jacob had much cattle.

In our own time we do not drive our herds from place to place to obtain better pasture, but our flocks and herds must be kept within bounds; and we supply them with roots and grain,

as we deem them wanting, in sufficient nourishment from our own pastures and well-filled barns of hay.

In consideration of the importance of the cow to mankind, the question arises, How shall farmers obtain the best breed of cows? What breed of cows will produce the greatest amount of rich milk for the food consumed? For it costs no more to keep a good cow than it does a poor one.

As to the best breed for farmers, that will depend on circumstances, whether for making butter, cheese-making or selling milk.

Much might be said in favor of the Jersey cow for the richness of her milk and the amount of butter which may be obtained from the smallest quantity of milk. They are becoming popular with some farmers. The larger breeds of cattle require more feed than some of the smaller kind. Some farmers consider them good for their milking quality.

The Ayrshire is considered by many farmers who have had experience in stock-breeding to be the most profitable to raise, giving the most in return for the amount of food consumed, and being best adapted to the climate of New England. They are becoming favorites of the dairy farmer. The Devons make good oxen, and the cows are considered good milkers.

Farmers, in the first place, must procure a cow from which to breed; then, instead of slaughtering all her calves for veal, raise her best heifer calves, and keep them in a good, healthy, growing condition until they arrive at maturity; or, in the language of another: "I believe it is much the best way for a farmer to raise his own cows. By so doing, with judicious management, he can always have a good milking stock. Raise the best cows in your lot, and keep them in a healthy condition."

Many think a young calf can live on little or nothing, and give it food just sufficient to sustain life. The consequence is, they always have a miserable-looking animal. I believe a calf will make a better cow for being kept growing and healthy when young. It gives her growth in all the elements together that constitute a good cow. I am not in favor of doing as some of our stock-raisers do—let the calf have the milk of one or two cows, and all the meal it will eat until it is eight or ten months old, to see how large an animal they can get, almost worthless, except to relieve some fancy farmer of a few hundred dollars

surplus funds. If farmers would make it a point to raise their own cows, we should have a much better milking stock than we now have.

Whatever breed the farmer keeps, whether Jersey, Ayrshire, Shorthorn, Devon or grade stock, the cow requires proper care and food. The better care and keeping she receives, the larger return she makes. Yet how often do we see them standing out in cold, windy or stormy days in March without shelter; or in the fall, to obtain their food, are let out in frosty mornings to eat the stiff and frozen grass, which affords them but very trifling nourishment.

AUGUSTUS LANE, *Chairman.*

PLYMOUTH.

From the Report of the Committee on Bulls.

The trustees have, very wisely as we think, excluded from premiums any but bulls of distinct breed. In your offer for premiums you specified by name the Jersey, the Ayrshire, the Devon, and then say "for any other pure blood." The only other pure-blooded bulls that have competed for the society's premiums are the Durham and Dutch breeds. The Herefords, Kerrys and Jamestowns, have never been offered, we believe, if the latter may be called a distinct breed. Permit us to make a brief statement as to the different breeds and the encouragement these breeds should receive, as we think, from the farmers of the Old Colony.

The Jerseys or Alderneys are one of the oldest breeds known, their history extending back several hundred years, some say a thousand or more. In our own country they have been like most of the other breeds, of recent introduction, but by natural increase and fresh importations they have become the most numerous of the imported breeds except, perhaps, the Durham or Shorthorn. Their introduction into the Old Colony was but about twenty years since, some we think, by direct importation. Nahum Stetson, of Bridgewater, Seth Bryant, of East Bridgewater, and C. G. Davis, of Plymouth, have been large owners and raisers of this stock; latterly several gentlemen in Hingham, besides a large number who own from two to eight animals. The advantages claimed for the breed are: First, the richness

of their milk, the *finest yellow* butter being made from comparatively small quantities of milk, the cream of which is made into butter readily. Second, their power of *constantly* producing milk. Third, their docility or easy domestication, becoming readily pets in the family. Fourth, their producing calves at an early age. The objections are: First, the smaller quantities of milk given, of which we have some doubts, if we consider their *time* of giving milk. Second, that they are not as hardy as natives and some others, which in *some* cases means they would starve more quickly; but the fact that no farmer can *afford* to keep a cow otherwise than well, would, as we think, generally answer this objection. Some minor objection may lie against individuals, but not against the breed generally.

The Ayrshire was introduced somewhat earlier into the State than the Jersey. The large quantities of milk given for the size of the animal, with no objection on account of hardiness, makes it a favorite with many and worthy of our consideration. It is not as numerous as the Jerseys in the county, and it remains to be seen which will be the favorites of the farmers.

The Devons are a very old breed, and they have been much improved abroad since their first introduction, in the shape of our old red native stock. Mr. Nahum M. Tribou was, at one time, a large raiser of the improved Devons. It is not now a special favorite, though many claim that for cream and beef it has fine qualities. The cows generally give good milk. We believe no bulls of this breed have been offered for premiums for several years.

The Durhams are esteemed wherever nice beef and large oxen are wanted, and many of the cows are fine milkers, but it is generally thought that our pastures are not sufficiently rich to raise so large a breed. They are probably much the most numerous of the pure bloods in the country. Where there is good pasture, or cattle are stall-fed, they will always be favorites. But few Durham bulls have been offered for premium in this county.

The Herefords are scattered through the country, and are esteemed for their activity as oxen. We know of none in this county.

The Kerrys have but few representatives in the county; they are very small, and their introduction will not be rapid.

The Jamestowns were sent over in the Jamestown, on her return from Ireland, in the time of the Irish famine, after delivering the supplies forwarded by the munificence of the citizens of Massachusetts. It is known mainly in Norfolk County, where it takes many premiums. We know nothing of its being a distinct breed.

A few gentlemen have recently imported some Bretons, of which we know but little.

We have thus taken a cursory glance at the imported breeds of cattle, and we believe that our stock raisers would find it for their interest to raise pure-blooded stock, as the demand will doubtless be greater than the supply for many years to come.

Take for illustration the Jerseys; the present importations are costing from three to six hundred dollars apiece, and we think we have as fine animals as are now imported, but at the price of two hundred dollars for a cow, there is quite a profit in raising heifer calves of that breed, while it is doubtful where would be the profit in raising calves of native stock.

We think the society should in some way encourage the entering of the pedigree of our full-blooded stock in the various herd-books, inasmuch as greater care would be used in breeding. The stock raiser can realize a much larger price for a cow of which he can give the pedigree than one of which he cannot, so that the wealth of our farmers would be increased by such a course, especially if we would send our animals out of the county; and we should also be relieved of the not unheard of imposition of palming off grade stock as full blooded.

HARRISON STAPLES, *Chairman.*

NANTUCKET.

From the Report of the Committee.

THOROUGHBRED STOCK.—The Committee on Thoroughbred Stock respectfully report, that the exhibition this year was very creditable. There was not so great a number of animals, taking in natives, grades and blood-stock, as at the last fair; but the value of the stock in money was far in excess of last year. The largest part of the thoroughbreds were Jerseys, and although the animals exhibited did not constitute much more than half the number on the island, yet there were enough to

show that many gentlemen are turning their attention to this kind of stock. There are those in our midst who are croaking about Jerseys, and pretending to fear that the "bubble will soon burst," and that the price of this class of cows will fall down to natives, and even below. Your Committee at present are not apprehensive of any great falling off in the demand for Jerseys. Their reputation for producing a large proportion of cream is not disputed. The only answer is, that "if they only give half as much milk," then double the proportion of cream is just equal, except that the farmer has only half the quantity of skim-milk for his pigs. All that sounds well if it were true. But the record of various herds, here and elsewhere, shows that from the Jerseys about as large a quantity of milk is obtained as from the best natives. Now we do not pretend to say that the best native cow in the State does not give more milk and more butter than the poorest Jersey. But what we will say is, that fifty Jersey cows, taken indiscriminately, will give more milk than fifty natives, and more than twice the amount of butter, on the same feed. If this be true, there is no danger of getting a surplus of these cows on hand at present. As a "gentleman's cow," she is acknowledged to be head and shoulders beyond any other cow. A person of means, who keeps one cow to supply his own table, can get a nicer milk and a better butter from a Jersey than from any other cow. The average price of Jersey butter in the large cities is fifty per cent. more a pound than any other kind.

When it is remembered that acccording to the last United States census, 1860, the number of cows in the United States was nearly *nine millions*, (8,581,735,) and that among this somewhat extensive herd there was, in 1869, this very last spring, little more than *one thousand* Jersey cows in the whole republic, there is not much danger of a surplus at present.

The record, as we gather it from Charles Wyllis Elliot, Esq., who publishes the table in the September number of the "New York Galaxy," is as follows:—

Massachusetts, ...	293
New York, ...	202
New Jersey, ...	164
Pennsylvania, ...	111

Maryland,	104
Connecticut,	60
Rhode Island,	45
Ohio,	35
Kentucky,	22
Missouri,	15
Vermont,	5
Maine,	2
Total,	1,058

There seems to be some confusion in the minds of many, and some among them breeders even, with reference to the Alderney and Jersey cows. The vessels which trade at the Channel Islands usually touch at Alderney last, and so were reported in London as having arrived from that island with cows, which, though really from Jersey, were thus called Alderneys.

The island of Jersey, just alluded to, is in the English Channel, is about twelve miles long and six broad, containing about forty thousand acres. The northern coast is a high, rocky bluff, rising nearly four hundred feet from the sea, and then gently sloping away to the south. It contains about sixty thousand people, and is productive enough to maintain them. In 1868, it was found that there were on this island six thousand four hundred and twenty cows. The English have been for sixty years drawing from this stock, and America for the last twenty years. There is more of a mania to-day among the rich men of England for the Jersey cow than there is in the United States. The price now of a fine Jersey, which was once about £10, has gone up to £40 or £50. The effect of this continual drain has been a loss to the island of its best cows, so that now the most competent judges admit that "better specimens exist now in this country than can be found in the island of Jersey, and that many herds in England are greatly superior to any herds in Jersey."

Now why is this desire for these expensive cows? Is it all a whim? Is it only because of her beauty? If such be the case, England has been pursuing a shadow and a phantom for more than sixty years.

Mr. Morton, of Farmington, one of the most distinguished

breeders, says: "Seventeen years' experience convinces me, unqualifiedly, of their superiority as butter-makers."

Judge George, of Orange County, N. Y., says: "I have bred Durhams, Ayrshires and Devons, and I think the Alderneys *decidedly* more profitable for butter."

Mr. Goodman, of Berkshire, "has made a pound of butter from five quarts of milk."

Messrs. Converse and Flagler's account of their own two cows, "Lady Milton" and "Cream Pot," is perhaps unequalled. It is as follows, for June, July and August, 1868: "Lady Milton," product, milk, 1,595 quarts; product, butter 249 pounds and a fraction. "Cream Pot," product, milk, 1,533 quarts; product, butter, 239½ pounds.

Our farmers will notice that we speak of the Jersey cow as a butter cow only. The farmer who simply wants the most milk to sell by the quart, meaning to kill off his calves when they are very few days old, that his cans may be filled, might find it more profitable to him to have Ayrshires or grades or good natives. In fact, we have no doubt that the Ayrshire, for cheese and quantity of milk, is ahead of the Jersey. Yet we have no doubt that a farmer who intends to sell milk and raise his own stock for that purpose, will do a great deal better by having thoroughbreds, whether Shorthorns, Ayrshires or Devons, than natives or grades.

There are but few who appreciate the quantity of milk used in the United States. The trade for a single locality is enormous. Into the city of New York alone, each day there comes a great stream of milk over the Harlem road, another over the Erie Railroad, another over the New Haven, another by the Hudson, and still another by the Long Island. Twenty-five thousand dollars' worth of milk a day comes flowing into this one city—more than $9,000,000 worth a year.

The milk in this county, for the last ten years, has increased to an average of five quarts a day to each cow, from about three quarts. Now, when we remember that the number of cows in the States is this day over nine millions, and the annual value of their milk is over six hundred and seventy-five millions of dollars, what a vast work would the farmers do to increase that, as we have in Nantucket, two-fifths. Who would be mean enough to talk about repudiation, when the national debt of the

country can be paid in about three years out of the milk-pails of the United States alone?

There are farmers who undertake to keep cows, and neither feed them well nor house them well. To such it makes but little difference whether they have Ayrshires or Alderneys, natives or grades; they will have a lot of poor cows, let them come from what stock they may. A man who keeps more cows than he can feed, who has a dirty and ill-ventilated stable, will not only have sickly cows, but his milk will be rank and strong, his butter bad, and his cheese worse. Dirt, except when scattered on a man's pastures, never produced a farthing to a farmer. There is no economy in dirt. The good farmer keeps no more cows than he can feed well. If you go about the State, you will find poor cows and poor farmers. But the poor farmer is altogether the poorer of the two. A poor farmer will make a good cow into a poor one, almost as by miracle; while, on the other hand, a good farmer will make a very fair cow from a poor one, or fat her at once for the shambles. If poor farmers could be disposed of in some such summary way, it would be a blessing to the country and a day of jubilee to the cows.

A man that will starve or abuse such a mild, beautiful, forbearing and *Christian* animal as a cow, is fit only for the loneliness of the desert. Even when she is kicked and sworn at and half fed, and, when maternal affection is most strong, we take from her her first-born, that she would like to lick and ramble about the green pastures with, so that we may make money from her yield of milk, she still turns up her mild eye in calm resignation, and goes uncomplaining to her poor and slovenly shelter, without a murmur or a look of reproach. What human beast would submit uncomplainingly to such a fate? E. M. GARDNER, *Chairman*.

SHEEP.

MARTHA'S VINEYARD.

From the Report of the Committee.

The merits of the several breeds of sheep with their crosses having been ably treated by the Committee for 1868, it is only

proposed in this report to throw out a few hints in regard to the rearing and general management of the flock.

The importance of keeping up the condition of the flock through the winter and spring, is admitted by all good breeders of sheep. If allowed to lose flesh during the early part of winter, their relish for proper food, and their ability to digest it is weakened, and their restoration during the winter and following spring, a difficult matter. The fleece grows but little, and much of it is frequently lost before the following shearing. The above evils may be remedied by feeding turnips, grain, refuse beans, or anything else that they will eat; the greater the variety the better until they will eat hay readily, when the grain, roots, &c., may be discontinued, provided the hay is of good quality. The flock, however, would be much improved by feeding grain and roots in addition. The writer has repeatedly carried a flock through the winter in good condition, by feeding what they would eat of any kind of marsh hay, with the addition of a liberal feeding of turnips—some four bushels to one hundred sheep daily.

When sheep begin to lose their relish for hay, induced by an early start of grass in spring, they should again be fed on grain, —even so small a quantity as a half gill per head daily will do much to keep up their condition, which will rapidly diminish at this time if not fed.

Sheep should be provided with a barn or shed on dry ground, with a door opening to the south, and otherwise well ventilated, which should be constantly well littered, and so large that all may lie down without coming in contact with each other. Although the flock may prefer to lie out in mild weather, they will resort to it and find comfortable quarters when the weather is severe. Feeding racks or mangers should be provided, three feet high, two and one-half feet wide, and any desirable length, and should be constructed by nailing boards one foot wide to upright posts on the sides and ends at the bottom; also boards which may be narrower, on the sides and ends at the top. Short boards, six inches wide, should be nailed from the bottom to the top boards, leaving space six or seven inches wide.

If flocks could be divided, and provided with separate accommodations, placing the ewes, the wethers, and the weaned lambs each by themselves, it would be much better than to have the

three classes together, as the weaker ones, in the latter case, would not get their full share of feed.

Perhaps the first of May is as good a time as any to have lambs dropped that are designed to be kept for breeding stock; but where the ewes are well cared for, especially when the lambs are designed for the butcher, a somewhat earlier time would be better.

Lambs should be taken off from the ewes the latter part of August or early in September, and placed in a meadow, and should be well cared for during the fall, following winter and spring, when such should be selected for breeding as combine the most desirable qualities.

HERMAN VINCENT, *Chairman.*

POULTRY.

MIDDLESEX.

Statement of George C. Wright.

I offer for your inspection and premium two coops of white Leghorns that are bred from fowls which have taken the first premium at the Middlesex Agricultural Fair. They were hatched the last of March, and are six months and a few days old—commenced laying when five months and two weeks old. I have kept black Spanish, Brahma pootra, and other breeds of fowls, but, for the size and number of eggs, white Leghorns are the best, in my estimation. My method of feeding is as follows: I give my fowls all they will eat, both summer and winter. In summer I feed them on rye, oats, pease, &c., for grain. A cake of scraps is also kept moistened so that it can be readily eaten. Fresh water is given them every day. In winter I give them, in addition to the above, scalded meal, mashed potatoes and meal, carrots, cabbages, and burned bone and crockery pounded. By feeding fowls in this way they are kept constantly laying, except for a few weeks, when moulting.

To the Committee on Poultry.

GENTLEMEN:—I have entered for your examination and the society's premium, one trio light Brahmas, six months old; one

trio Crevecoeurs, four months old ; one trio white Leghorns, six months old ; one trio silver-laced Bantams, one year five months old. The fowls are all pure bred, and from the best stock to be found. They have been fed on a variety of grains—oats, corn, buckwheat, wheat screenings ; also, corn meal, scraps, meat, and boiled potatoes. They appear to thrive better on such variety than when confined for any great length of time to any one particular grain ; they have been confined all the time in a close yard, where they could not pick up their living from the farm.

My stock is nearly all Brahmas, and I prefer that breed to any I have had, for the following reasons, namely :

They are very hardy, and quiet ; the best layers in cold weather, when eggs bring a high price ; the young chickens are very strong—much more so than most other breeds ; they grow quick, and are preferred by the dealers in the market, the eggs being five to eight cents a dozen more in Boston market in the winter than either Leghorns, Black Spanish, or the common fowls, not so much on account of their size, but because they are thought to be of better quality. I have intended, and tried to breed, a good shaped, broad, square-built, compact fowl, rather than a coarse, over-grown, long-legged one, believing that they mature quicker, lay eggs younger, and more of them. These in the coop are almost precisely like fifty more at home. The Brahma pullets on exhibition have been laying for the last six weeks.

The Crevecoeurs were raised by me from stock of one of the best importations that has been made ; they are very heavy fowls and mature quickly. Not having bred many of them, I cannot give my opinion as to their final value. The Bantams are first-rate layers, but we keep them more for their beauty than for profit. The Leghorns are very superior fowls ; they are great layers in the summer, but not so good to lay in the winter as the Brahmas. I have annexed an account of receipts and expenditures—everything that has been bought for their keeping. I have not charged anything for use of buildings, care, and interest, as I am satisfied that the manure will pay well for all those items.

Oct. 1, 1869. Stock on hand, 54 hens, 2 cocks and 17 chickens, ...	$125 75
Oct. 1, 1868. Stock on hand, 54 hens, 3 cocks, .	114 00
Excess Oct. 1, 1869, ...	$11 75

ACCOUNT OF RECEIPTS AND EXPENDITURES.

CR.		
By $416\frac{1}{4}$ dozen eggs, ...	$132 86	
hens and chickens sold, ...	96 16	
excess in value of stock, Oct. 1, 1869, .	11 75—	$240 77
DR.		
To feed from Oct. 1, 1868, to Oct. 1, 1869,	$163 64	
1 cock, bought in March, ...	5 00	
3 chickens, bought in June, . .	3 00—	171 64
Balance, ...		$69 13

Eight Crevecoeurs and six Bantams have been kept the whole season out of the above feed, but they, or their products, are not estimated in the above account. It must have cost at least $23 to have kept them; and, therefore, that sum must be added to the profits, which would make it amount to $92.13.

Also, one coop for premium, containing a trio of one-half Brahma and one-half Crevecoeur chickens, three months old. I crossed the Brahma and Crevecoeur breeds, thinking that perhaps I might obtain a cross superior to either. These chickens have grown very much faster than either the pure Brahmas or Crevecoeurs of the same age.

JOHN H. MOORE.

WORCESTER NORTH.

From the Report of the Committee.

We firmly believe that in giving our influence to encourage the improvement of poultry, we are contributing largely to the support of the agricultural interest of the State. Unfortunately, there are not, so far as we know, reliable general statistics existing to show what is the proportion which poultry bears to the other farm products of the Commonwealth; but it is believed that neither

producers nor consumers are fully aware of the magnitude of the interest and product. The demand for both the meat and eggs of fowls is steady, and the supply is never in excess of it. There is no branch of the farmer's interest where science can be applied with better pecuniary results than poultry raising. We believe that all failures are traceable either to blindly divorcing nature from science, or to a non-application of science in the management of fowls.

All developments of permanent value are only possible by conforming to the special law of the quadruped or biped sought to be improved. We think our poultry men would do well to observe closely the law of nature in even the feeding of poultry. Let them not lose sight of the fact that the fowl is physically constituted to live on *whole grains*, and that to ignore or disregard this necessity of the fowl is to invite failure in some if not in many points. All domestic fowls require green herbage, and, if deprived of it for any considerable time, they inevitably decline. Hens, during the laying period, require animal substance in some form, and it is absurd to expect a good crop of eggs unless this condition is supplied. In the agricultural papers we find a good deal bearing on the subject of supplying the shell-producing substances; and although too much stress can scarcely be laid on this point, we think that science will yet demonstrate the impropriety of presenting limey material in a crude state. Scientific farmers and others are getting indoctrinated with the fact that our lands lack lime, and that, consequently, there is a deficiency of that material in our grains. At present our wheat contains but about 45.2, in 1,000 parts, of lime, calcium (the metallic base of lime), magnesia, soda and phosphoric acid. Providing this is sufficient for the osseous tissues, there is still too little to make the shell of the egg; but the question is, how shall we remedy the deficiency? We argue that if the land is deficient in phosphates, lime, salt, &c., they should be administered only to the land in crude state, thus supplying the want in plants and fruits, they supplying it to animals which consume such fruits. Some years ago, the writer made some experiments in administering limey substance to fowls. Having a quantity of air-slaked lime, it was mixed with the dough in the proportion of about half a pint to six quarts of meal, and fed to hens, while laying, with most excellent results. Later,

the writer has had his attention called to the propriety of administering the egg-producing material in the form of bone-meal. A correspondent writes as follows:—

"Last winter I procured two barrels of bone-meal, intending to use it for Irish potatoes and other garden crops. My wife, however, appropriated some of it to manuring her roses in the flower garden, by simply strewing it on the surface of the ground around the bushes. The fowls have free access to the garden, and were discovered eating the meal very eagerly. Thinking it might be of service to them, we gave them some for several weeks, and I assure you it was but a short time before the eggs began to come in such numbers as we had never before known! If a nest was broken up to prevent a hen from hatching, it was but a few days before she was laying again, and thus it continues until the present time.

"One hen has taken possession of a barrel which has some bone-meal in it, and is laying in the meal. Whether she intends to lay the barrel full or not, time alone will determine.

"My wife thinks that care and bone-meal are great institutions for her poultry yard, and very extraordinary in their effect; but as the hens have an unusual amount of cackling to do, fears they may bring on bronchitis! This manuring of hens to make them lay we think is original, but we have no idea of taking out a patent for it, and hence leave the discovery open to the use of all who may choose to try it."

In closing this Report, your Committee would further urge upon the attention of all our farmers the value of the dunghill fowl, both as an always marketable product of the farm, and for the virtue of its excrements as manure. In these days, when beef claims such high prices, and pork is liable to the charge of unwholesomeness, we can fall back upon poultry, with the certainty of living as well, if not better; while that we should be as well off, pecuniarily, we think does not admit of a doubt.

A. B. DAVIS, *Chairman.*

BRISTOL CENTRAL.

From the Report of the Committee.

The kind most largely represented was the Brahma-pootra, and your Committee, as usual from the excellence of the speci-

mens exhibited, were more embarrassed in awarding premiums to this class than any other. As there seems to be great diversity of opinion as to what constitutes the chief excellence or best points in this favorite and valuable breed, it may be well to enumerate, somewhat specifically, the points deemed most important by the London Poultry Club, (whose standard of excellence in relation to all breeds has been adopted by the American Poultry Club,) for the information of breeders :—

GENERAL SHAPE OF ALL BRAHMAS.

"Beak very strong, taper and well curved. Comb, pea, small, low in front and firm on the head, without falling over on either side, distinctly divided so as to have the appearance of three small combs joined together in the lower part and back, the largest in the middle, each part slightly and evenly serrated. Head small and slender; deaf ear large and pendant; wattles small and well rounded on the lower edge; neck long, neatly curved and slender near the head; breast very full, broad and round, and carried well forward; thighs very large and strong, covered with short fluffy feathers curving inward round the hock so as to hide the joint from view; vulture hocks, that is, with hard, stiff feathers projecting in a straight line beyond the joint, —an objection but not a disqualification; legs rather strong and large, standing well apart very abundantly feathered down the outside to the end of the toes."

The color of the light Brahmas, which are most extensively bred in this country, is given as follows:—

"Comb, face, deaf ear and wattles rich bright red; head white; neck white, with a distinct black stripe down the centre of each feather; breast, under part of body and thighs, white; saddle, white striped with black; wing bow and coverts white; wing primaries black; wing secondaries white on outside; web black on inside; web tail black; tail coverts glossy green-black; lesser coverts silvered on the edge; legs bright yellow; feathers white, slightly mottled with black."

It will be seen from the above that pea combs are considered the best. The single combs are not, however, a disqualification, and the following enumeration of the points show that this advantage may be more than counterbalanced by other excellences.

POINTS IN BRAHMAS.

Size,	3	Legs and feathering,	1
Color,	4	Fluff,	1
Head and comb,	1	Symmetry,	2
Wings, primaries well tucked under secondaries,	1	Condition,	2
	9		6—15

Breeders of Brahmas are earnestly requested to study the above points. The Brahma fowl has become, perhaps, the most common of all the distinct breeds, and the fixing of a more definite standard than has been generally recognized seems necessary, in order to save your future committees from obvious embarrassment. We take the liberty of making a few general suggestions upon other breeds. The Hamburg varieties must have slaty blue legs. In the Leghorns, yellow are preferred, though white is not a disqualification. Dorkings of every color, must have white legs, inclining to pink. Games may have willow, olive, white, yellow, blue or bronzy black legs—the colors preferred in the order in which they are named. The color of the hen's legs should match those of the cock.

The noble family of Game fowls was represented by ten coops many of them of great beauty, though few were in good feather, our exhibition occurring too early in the season to do justice to the old or the young birds. There is, perhaps, no breed more truly valuable for the farmer than the Game. Its good qualities are so evenly balanced that, for general purposes, it has no superior, perhaps no equal. The hens are excellent layers, the best of all setters and mothers, being active, vigilant and fearing nothing when they have their young broods around them. They are also remarkably hardy. The cocks are very gallant, seldom or never taking a dislike to one of the flock and persecuting her unceasingly, as is not unfrequently the case with many other breeds. They are brave, but not quarrelsome, seeming to feel conscious of their superior strength and skill, and as if disdaining to engage with foemen unworthy of their steel. They take little or no notice of the young cocks growing up under them. If attacked, a true blooded Game cock will fight to the death ; but after an experience of many years, we are convinced

that no one need fear to keep them on account of their warlike propensities. Those who indulge in the barbarous amusement of cock fighting usually breed them to weigh, not to exceed, four and a half to five lbs., it being difficult, they say, to match them at heavy weights. There is no difficulty, however, in bringing them to an average weight of five and a half to six lbs. by judiciously crossing of different strains. One of the cocks (a cross of the Derby and Sefton,) exhibited by Mr. Rodman, weighed seven and a half lbs., while the hens average over five lbs. This is, however, an extreme weight. A Game cock will improve greatly the stock of any yard where there is need of fresh blood.

The Bernicle and Brent geese are capable of being domesticated, and Audubon thinks there is no reason why the Eider duck, so valuable on account of its down, should not also be successfully reared in confinement, as it feeds readily upon corn and different grains. Great numbers of these are annually shot, under the name of "Isle of Shoals duck," every winter or spring, on Martha's Vineyard. We have no doubt that some of the enterprising sportsmen of that island might trap some of these without much trouble. They would, no doubt, prove a most valuable addition to our poultry.

COOPS.

Your Committee remark some improvement in the style of coops this year, but there is room for much more. Some of the coops, containing very fine birds, were apparently contrived with the express purpose of preventing the awarding of premiums to their occupants. This defect is always noticeable in the case of the largest birds, such as turkeys, geese, &c. The difficulty of transporting coops large enough to show these to advantage is obvious. Your Committee would renew the recommendation made last year, that a few large sized coops be purchased by the society. They can readily be made principally of wire netting, so as to fold up in a small compass. Any quantity of these might be stored in the hall of the society, to be brought out at our annual exhibitions. Their average cost is about $3.00 per coop. If the society provide accommodations for the larger kinds of poultry, as it does for its annual show of sheep, swine, &c., we

think the attractiveness of our exhibitions would be largely increased.

Only four exhibition coops were entered for premium, and none of these were of a very high order of excellence. There is one precaution which should be taken, in accordance with a due regard to the health of the fowls; all coops should be not less than two feet high, and close on the backs and sides, (with the exception, perhaps, of a slight opening for ventilation towards the top,) in order to avoid drafts. It is a cruelty to expose fowls to the cool night air, in coops open upon every side.

GENERAL REMARKS.

We have alluded, in the opening part of this Report, to the growing interest in poultry, as evidenced by this exhibition. We have no disposition to magnify unduly the department which we have the honor to represent; but being convinced that no part of a farmer's investment can be made more profitable than poultry under a wise and intelligent system, we venture to offer a few general suggestions on this subject.

There can be no doubt that the demand for eggs and poultry in all of our large towns and cities is rapidly increasing. The quantity of eggs consumed in the city of New York, for culinary purposes alone, must be at least 500,000 eggs per day. In addition to this, there has sprung up within a few years a large demand from the manufacturers of albumenized paper for photographic purposes, one establishment in the city of New York alone consuming 900,000 per annum.

If we consider the average price of eggs and poultry during the past year in this vicinity, which has been about thirty cents per dozen for the former, and say twenty-eight cents per pound for the latter, together with the average cost of corn, it seems clear that there has been a handsome margin for profit.

It has been ascertained that one hen consumes not to exceed one bushel of corn per annum. She will lay about one hundred and twenty eggs per annum. Suppose we take a flock of twenty

hens and three cocks, costing one dollar each, . .	$23 00
Estimated cost of poultry-house and fixtures, . .	27 00
	$50 00
Twenty hens will produce 200 eggs per annum, at 30 cents per dozen, ...	60 00

They will consume annually 23 bushels of corn, at $1.10, ...	$25 30	
Interest on stock and fixtures, . . .	3 00	
		$28 30
Balance to credit of poultry account, . . .		$31 70

It will be seen that there is here a profit of about forty per cent. It does not follow that the same result will be reached with largely increased numbers; but if plenty of range be given, and due care taken not to crowd the poultry together at night, the profit will approximate, we think, quite nearly to the above estimate. The value of the manure will more than pay the depreciation of stock and fixtures.

Let every farmer remember that the almost exclusively laying fowls, such as the Leghorns, Black Spanish, Houdans and Hamburgs, will be most profitable, if eggs only are his object; while the Brahmapootra, Gray Dorking, Game, Dominique and their crosses will be the best for general purposes, especially if early chickens are desired for the table. The Brahmapootras should be disposed of after they are two or at most three years old, and no fowl should be kept over four years, unless the breed is choice and rare, as they deteriorate after that time. Let his motto be, not more than fifty in a flock, dry, clean roosting houses, and plenty of grass. With these precautions, almost any breed will do well; without them, disappointment and failure are almost certain.

EDMUND RODMAN, *Chairman.*

DAIRY PRODUCTS.

WORCESTER WEST.

From the Report of the Committee.

BUTTER.—Butter is an important farm product, when we consider its quantity and value, its general use in all classes of the community, and its sanitary influence as an article of food. Butter is now not only a necessity, but a *prime* article is a *lux-*

ury. The consideration of this topic is important, from the fact that a much less quantity is produced than might be, with the same outlay of capital and labor; and still more important from the sad fact that much of it is so poorly manufactured. It is estimated that more than a million of dollars is annually lost to the producer and consumer from poor butter.

Let us hint at some of these great *leaks* in this branch of dairy farming. First, the character of our milch cows, their feed and their treatment.

The cow from whose milk we wish to manufacture butter, should not only yield a fair amount of milk, but this milk should be rich in the amount of constituent elements needful to make butter, abundant in quantity, yellow in color, firm, well-grained in texture, and "nutty" in flavor. Every dairyman knows that cows vary in the above particulars. It should be the earnest endeavor of the butter dairymen to obtain cows that are known to have descended from a "butter family," to rear their progeny, and thus improve the butter-making herd in this county.

The feed of the cow should be in abundance, and contain all the constituent elements that enter into the composition of milk rich in butter properties. The cow is only a vitalized manufactory to change the elements of grasses, roots and cereals into milk appropriate to the uses of man. The cow can no more secrete milk suitable for good butter-making without appropriate feed, than the Israelites in Egypt could make brick without straw. The cow, in summer and autumn, should feed on the succulent grasses, as clover and timothy, and not on white-weed, thistles and brakes. To improve the manufacture of butter in our county, we must improve our pastures; cut down and utterly eradicate bushes, hardhacks and other noxious weeds, apply compost, ashes, salt and lime, also gypsum or plaster of Paris, and the green grass will wave, and the white clover will dot our hillsides.

The milch cow should have hay in winter not overdried, and the grass for the hay should be cut when in blossom or the seed soft and doughy. The quality of the grass should be improved by fertilizers. It is economy, nay, capital, to get out the rocks and use the modern agricultural implements in cutting, curing

and storing hay. We have already taken a too long "Van Winkle" nap.

In the drought of summer and autumn we should have corn or millet for soiling; also roots, as carrots, sugar-beets and turnips, to give variety to the winter feed. The milch cow should have, both summer and winter, an abundance of *good* water to drink. Muddy water or stagnant pools produce disease in our cows. She should be kept quiet, both in the pasture and yard or stable, driven carefully, milked gently, with little or no conversation while being milked. Blows with the milking stool and loud talking arrest the uniform flow of milk. The stables should be well ventilated, warm and dry; and be assured, the dairyman will be rewarded by his flowing pails of milk and his golden rolls of butter.

Second, I will pass to the manufacture of butter. Heat, light, moisture and ventilation or change of air, influence the milk while the cream is rising, or the separation of the elements that form butter, from the caseine, (cheese element), and other component parts of good milk. Uniform temperature for the season, subdued light, constant but moderate change of air, facilitate the rising and amount of cream, also its quality.

To secure, measurably, the *control of all the above-named agencies*, so as to have their activity not only tolerably uniform, operating with that energy found by observation to be best adapted to attain the desirable result, namely, a prime article of butter, is the great desideratum in the construction of a milk-room and care of milk. Not only the arrangement and construction of the walls inside and outside of the room, but *locality* should engage the farmer's attention. But few persons realize how readily milk and butter absorb surrounding odors. A slice of the latter becomes air-slaked in a few hours.

Every butter dairy should have an adequate supply of pure soft water. The most *scrupulous cleanliness* is demanded with the pails, pans, churn and butter-tubs. The process of churning, salting, working and packing butter demands time, close observation and labor.

The West and South can raise corn and wheat more cheaply than we can, and these cereals are transportable to our doors at all seasons. Meat can be brought from Texas and Illinois, with advantage to both producer and consumer. Cheese is less

perishable than butter, consequently can be transported as well as exported with less detriment than butter. For these reasons our cities and manufacturing villages will look to our farmers for a nice, fresh, healthy article.

Why cannot Worcester County have as good reputation for butter as Orange County, N. Y.? If more intelligence, care and persistent labor are required in this branch of farming, let us give more brain-work and hand-work to this necessary and healthy vocation.

If not irrelevant, let me suggest that the butter dairymen and their wives meet in their respective towns this winter, or other places deemed most practicable, to consider and socially examine the whole question relative to the manufacture of butter.

And permit me to ask, why should not our daughters have the advantage of scientific culture in chemistry and kindred sciences as well as our sons? In the manufacture of cheese, of butter, in the different processes of cooking, more or less chemistry is involved. Why not open the Agricultural College at Amherst to our girls? Equality before the law is now the "shibboleth" of our country. As we are in favor of the adoption of the Fifteenth Article of Amendment to the Constitution, we are as decidedly in favor of the education of our daughters at our noble State institution, as fully and as completely as we are our sons.

From the Report of the Committee.

CHEESE.—The "cheese factory is among us," and bids fair to make a complete revolution in this branch of manufacture. Will it be a success? It is too late in the day to doubt it. Like all other new enterprises, they require time and patience to develop them, but the result is certain. It is supposed by many, that these establishments are designed particularly for those doing business on a large scale and not adapted to small dairies. But this we think is a mistake. The cheese made from five or six cows, more or less, cannot be equal to that produced by a large number. The cheeses are too small, they are hard and dry, and not what the market calls for, either for home consumption or export. A large portion of the cheese that goes to market, is retailed at the counter of the grocer in small quantities, and for this purpose the large-sized cheese is preferred,

and will sell in the market for a handsome percentage over the small cheese of the household dairy ; so that in the opinion of your Committee our small farmers are particularly interested to connect themselves with the factory ; as in that case the milk of their few cows is as valuable in proportion as the milk from the largest dairies, to say nothing of transferring the labor of cheese-making from the farm-house to the factory, where it will eventually be done at a much less cost than in the individual dairy rooms, thus relieving our mothers, wives and daughters from a task that at the present day they are so unable to perform, or saving the cost of female labor, which is not only very expensive, but often very vexatious.

Cheese, in the opinion of your Committee, is the most important agricultural article that can be produced in this part of the country. We can, as it seems to us, have no other great staple. It becomes more apparent every day that beef, pork, wool, hops and all breadstuffs and grains can be sent to market from other sections of the country, at much lower prices than can be afforded in this vicinity. The towns included in the "j·urisdiction" of this society, so to speak, are best adapted to the production of hay and grass, and these it has been abundantly proved, can be made into milk at a better profit than into anything else. And besides, it may be said truly that we have a reputation for the production of cheese in this vicinity that has been of value to our farmers in the past, and ought not to be lost in the future. This reputation is founded, as we believe, not only upon the perfection of its manufacture, but the material out of which it is made, the grass grown upon our hillsides, which partakes so largely of the white clover, produces a whiteness of milk and cream that manifests itself in the product of our dairies, whether in butter or cheese.

This, then, should be our specialty, in this part of the country, and all should co-operate to increase the quantity and improve the quality of this important article.

We have already said that the quality of our cheese has been greatly improved through the influence of this society, by stimulating inquiry as to the requisites of a good cheese, and the way to produce it, and we may say to the credit of our farmers, that they have had no secrets in their business. They have freely communicated their "*modus operandi*" to all inquirers.

No notice of "Positively no Admittance" has been on their doors. So far from that, the presiding genius would be but too happy to communicate all the facts and experience connected with the establishment, and make a full display of all the tools and fixtures, together with a full view of the dairy product in the cheese-room. And if visitors should admire a shelf of noble sage cheeses, they might be informed that corn leaves and potato tops would color a cheese as handsomely as the best sage that ever grew!

Whether the same courtesy will obtain between the different cheese factories is doubtful. Should some one of them discover a process by which a percentage could be added to the weight of cheese from a given quantity of milk, we doubt much whether the information would be thrown into the common stock for the benefit of all concerned. However this may be, we hope that the manufacture will be carried to the greatest perfection, and that our factories may endeavor to have a common reputation which may be known wherever there is a cheese market. The export demand for cheese is frequently for large lots, and it is desirable that they should be essentially "one chop." We make these remarks as to cheese factories, because we think the future of the business is in that direction, and that our farmers would do well to turn their attention to this subject.

FREEMAN WALKER, *Acting Chairman.*

HINGHAM.

From the Report of the Committee.

BUTTER.—Inhabitants of this manufacturing State of Massachusetts, as we are, we hardly realize the extent to which the art and business of butter and cheese making has been carried in this country. Dairying has, within the last few years, engaged the attention of the farmers throughout the Eastern, Middle and Western States, and the "American system," as it is called, has become an important branch of national industry. A few statistics may be of interest.

American dairying now represents a capital but little short of \$1,000,000,000. The cheese product of 1867, sold for \$25,000,-000, and the butter product for \$100,000,000. In the same year, the product of the New York dairies sold for more than

the entire grain crop of the State, and three times as much as the whole wool clip. From the United States census of 1860, we learn that the value of the dairy products of all the States, at that time, could not have been less than two hundred millions of dollars, that it was worth nearly as much as the cotton crop, and was one-ninth of the total agricultural products of the whole country. The product of cheese, now made in the United States, is greater than that in Great Britain, and a large quantity is annually shipped there. It has been estimated that there are now, almost one thousand cheese factories in the State of New York alone, and over twenty in the State of Massachusetts. There are also many butter factories in the country, and butter-making has become a specialty with many farmers.

But, although dairy farms are becoming valuable, and dairy farming profitable, we can hardly expect, in Massachusetts, where our farms are small and our population large, to produce much butter or cheese for export. If we can supply the demand for home consumption, we shall do well. But we ought, at least, to make *good* cheese and *good* butter, and this we can do with proper care. To be sure, we need good, healthy cows, and good feed, but these we usually have. Then, as in bread-making, we want care; indeed, oftentimes, hard work, for as dough must be kneaded, butter must be "worked." The question of salting seems to us to be, in a great measure, a matter of taste; some like more and some less, but a certain amount of salt is necessary, of course, for all butter that is to be preserved.

ARTHUR LINCOLN, *Chairman.*

SUPPLEMENT.

PRIZE ESSAYS

ON

ROADS AND ROAD MAKING.

PREFACE.

In his Inaugural Address to the legislature of 1869, His Excellency Governor Claflin used the following words :—

"Closely connected with our agriculture and other prominent interests is the system of public highways. Few things are of greater importance to a community, or a surer test of civilization, than good roads. Those of our citizens who have visited Europe are unanimous in the opinion that our public roads are far inferior to those of other countries, where the means of easy and safe communication are better appreciated. The science of road-making is, apparently, not well understood; or, if it is, the present modes of superintending the construction and repair of roads are so defective, that the public suffers to an extent of which few of us are aware. It may be found, upon investigating the cause of our miserably poor and ill-constructed roads, that the laws relating to this subject need revision, so as to give more uniformity in the construction and the repair of our highways. It is evident, also, that the science of road-making should have a prominent place in the course of applied mathematics at the Massachusetts Agricultural College."

This suggestion was embodied by the legislature in the form of a Resolve, offering prizes for an Essay or Essays upon Roads, in the following words:—

RESOLVE CONCERNING THE CONSTRUCTION AND REPAIR OF ROADS.

Resolved, That there be allowed and paid out of the treasury of the Commonwealth the sum of four hundred dollars, to be expended under the direction of the board of agriculture, in the payment of

one or more premiums for the best treatise or treatises, containing not more than two hundred pages duodecimo, respectively, upon the science of road-making and the best methods of superintending the construction and repair of public roads in this Commonwealth; and that said board are also authorized to cause to be printed, for the use of the next legislature, three thousand copies of the treatise receiving the highest premium under this resolve, if they shall deem such publication expedient. [*Approved, June* 12, 1869.

The subject was referred by the Board to a Committee consisting of Messrs. James F. C. Hyde, of Newton, Avery P. Slade, of Somerset, and Newton S. Hubbard, of Brimfield, and this Committee was authorized to offer, on behalf of the Board, one or more prizes as, on mature consideration, it should think best. The Committee issued the following circular:—

ROADS, AND ROAD MAKING.

The undersigned, a Committee of the State Board of Agriculture, would respectfully call your attention to a Resolve, adopted by the Massachusetts legislature at its last session, and approved June 12th, 1869, "concerning the construction and repair of roads;" a copy of which is hereto annexed.

The Board of Agriculture offer $200 for the best, $125 for the second best, and $75 for the third best treatise on the subject of road making and repair, as provided for by the Resolve; the same to be sent to Charles L. Flint, the Secretary of the Board of Agriculture, State House, Boston, on or before January 28th, 1870, for examination. All manuscripts, whether receiving an award or otherwise, to be at the disposal of the Board. As the time is short, it is earnestly desired that the subject may receive immediate and thorough attention, as it is one of very great importance to the whole State.

JAMES F. C. HYDE,
AVERY P. SLADE,
NEWTON S. HUBBARD,
Committee.

DECEMBER 13, 1869.

A wide-spread interest was awakened in the subject. Nearly thirty essays were submitted for the inspection of the Committee, some of them by writers residing in other States. These essays differed widely in their character. Some of them were scientific and elaborate; others meagre in extent though often containing suggestive and useful hints. No one appeared to the Committee to embody all that was desirable, or to form in itself a full and comprehensive treatise adapted to the wants of both cities and towns, or large centres of population and sparsely inhabited districts.

The general principles of road making may be the same, but it is evident that they cannot be applied with equal completeness under all circumstances. A city street, or a road in the neighborhood of large and wealthy centres of population is one thing, and a country road, little frequented, is another. A sandy road on Cape Cod, where both clay and gravel are inaccessible, and a rocky mountain road in Western Massachusetts, would require somewhat different treatment.

Nothing certainly need be said of the importance of good roads. No community can afford to be without them. The wear and tear of vehicles and horse-flesh and muscle on a bad road is enormous; and it constitutes an indirect tax which probably amounts to very nearly as much as the direct tax upon the people. Strange as it may seem, public sentiment needs to be educated up to a full appreciation and realization of the difference between good and bad roads. Nor can it be questioned that the system of road making, as it has been adopted and applied hitherto in most of our towns, is defective and bungling. True economy would require a more liberal original outlay, if the public comfort and convenience did not, for the item of cost for repairs to follow would be materially and permanently lessened. Besides, the same power will move a much larger load, and do it with greater ease, with less wear and tear, on a solid, properly-constructed road, than on one of an opposite character.

The awards were made, after very careful study and consideration, with reference to the wants of all sections of the State, and though neither of the following Essays would be complete in itself, it is believed, that, taken together, as they should be, they present a comprehensive view of the subject, and that they will be found both useful and instructive, as furnishing suggestions worthy to form the basis of legislative action.

CHARLES L. FLINT,

By order of the Committee.

A FIRST PRIZE TREATISE

ON

THE SCIENCE OF ROAD MAKING.

By Clemens Herschel,

CIVIL ENGINEER, MEMBER OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

Introduction.

This treatise was written in answer to the printed circular of a Committee of the Board of Agriculture, calling for "treatises upon the science of road-making, and the best methods of superintending the construction and repair of public roads in this Commonwealth."

This circular was issued about the middle of December, and as the time for writing and sending in the called-for essays was limited to January 28, the writer has thought it best, no specific character being prescribed for the treatises, to attempt to write one suitable to be so called from the stand-point of the *public*, rather than from that of the civil engineer, and, giving results rather than the methods of arriving at them, to be as concise as possible.

The Science of Road Making.

Starting, then, with the first of the two subjects mentioned in the circular,—the science of road making, we can divide this into three periods: (1) laying out a road; (2) making the road-bed, which includes all earthworks, cutting and filling, culverts, drains, bridges, even tunnels, &c.; and (3) the making of the road surface; to which, not improperly, might be added, (4) keeping the road in repair.

Laying out a Road.

The considerations which determine the best location of a road, are those arising from the nature of the travel it is pro-

posed to accommodate; that is, from the admissible grades, radii of curves, &c. Given two points it is desired to connect, with no intermediate point where the road is to touch, that route is the best which will cost least to build and maintain, the grades and curves being kept within bounds; and to find this location constitutes the whole problem of the engineer.

The Romans built all of their roads in perfectly straight lines, up hill and down, at a very great expense, as being absolutely the shortest distance between two points. At a later period in history, it was argued that a road *must* be winding to be agreeable, and many were so built only for this reason. The modern road-builder or engineer in general, ignores any such considerations, and has for his aim only to achieve the most, at the least present and future expense.

As regards curves in roads in a hilly or mountainous district, we have then the rules never to make a smaller radius than 20 feet, and that only in extraordinary cases. On roads where long logging or other wagons may be expected, the smallest radius ought to be 50 or 60 feet; and, in general, 40–45 feet is none too much.

A rule sometimes followed in constructing mountain roads, is, where the inclination is 1 or 2 in a hundred,* heavy teams require 40′ and light ones 30′ radius; with a grade of 2 or 3 in a hundred, heavy teams require 65′ and light ones 50′ radius.

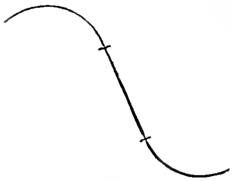


FIG. 1.

Where a reverse curve (shaped like the letter S) occurs, there should be a straight piece connecting the two curves, (Fig. 1.) On the contrary, where the two curves to be connected are concave in the same direction, the connecting link should be curved also, and not straight, (Fig. 2.) On the length of the curves the grade should be made easier than on the parts of the road immediately adjoining.

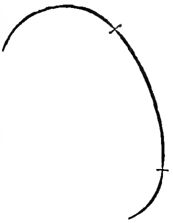


FIG. 2.

As regards grades, to start with mountain paths, we find pedestrians able to walk up an inclination of 100 in 120;

* In describing grades, the first figure gives the vertical height which is ascended in a horizontal distance given by the second figure. Both figures must of course be taken to refer to the same unit of length, thus: 100 feet

mules, ponies, &c., 100 in 173. For roads, Telford's rule was, that for horses attached to ordinary vehicles to trot up a hill rising 3 in one hundred, was equal to walking up one of a 5 in a hundred grade.

Experiments have shown that,—

1. On a road falling 2 in a hundred, vehicles would run down of themselves.

2. On the same kind of road, but having an inclination of 4 in a hundred, light vehicles had to be held back lightly, loaded ones, with considerable force.

3. On a road having a fall of $5\frac{1}{2}$ in a hundred, light vehicles had to be held back with considerable force, or if a brake was applied they had to be pulled, whereas heavy or loaded vehicles had to be braked to keep the horses from being speedily exhausted.

On inclinations steeper than 5 in a hundred, the rain-water running down the road is apt to do some damage to the road surface.

The regulations of different countries having a long experience in road building, such as France, Prussia, Baden, &c., vary somewhat, but the following is the general result.

In treating of roads, it often renders the subject much clearer, to divide them into three classes: first, second and third class roads, or, as we might also say, state, county and town roads. Accepting this nomenclature, we have this: for first class or state roads, the greatest inclination should not exceed 3–5 in a hundred; second class or county roads, 5–7 in a hundred; third class or town roads, 7–10 in a hundred. A road rising 10 in a hundred is not supposed ever to have any heavy teams upon it. In ascending a hill it is well and proper to decrease the grade as the top is reached, and in the same measure as the horses get tired. Thus, if a first class road starts up hill with a grade of $4\frac{1}{2}$ per hundred, it should gradually diminish to 4 and $3\frac{1}{2}$ in a hundred, and end near the top with a grade of 3 in a hundred. If a grade of 4 or 5 in a hundred must needs be kept up for some distance, then it is well to have resting places 40 or 50 feet

in 120 feet, 100 inches in 120 inches, or 100 miles in 120 miles, all express the same inclination to a level plane, and are more general in their application than the ways of expressing grades in so many inches to the foot, or feet in one mile, &c., &c.

long, having a grade of only $1\frac{1}{2}$ or 2 in a hundred, in the line of the road at proper intervals. An expedient adopted by Telford, the eminent English engineer, in order to avoid making a piece of road a mile long, on a less grade than 5 in a hundred, on account of the increased cost this would have occasioned, and yet not have this part of the road too much more tiresome for the horses than the rest, was to make the road-surface on this mile of a much better quality than on the remainder; the additional cost required for the improved road-bed amounting to only about one-half of what it would have cost to reduce the grade to say 4 in a hundred, as will be again referred to under the head of trackways. In sharp curves the grade should be only 1 or 2 in a hundred or level.

The following table gives the effects of various grades on the amount a horse can pull, and is based on calling the load a horse will pull on a level, one :—

Then, on a	grade of	1:100,	a horse	can pull . .	0.90
"	"	1: 50,	"	" . .	0.81
"	"	1: 44,	"	" . .	0.75
"	"	1: 40,	"	" . .	0.72
"	"	1: 30,	"	" . .	0.64
"	"	1: 26,	"	" . .	0.54
"	"	1: 24,	"	" . .	0.50
"	"	1: 20,	"	" . .	0.40
"	"	1: 10,	"	" . .	0.25

To determine whether it is most advisable to go over or around a hill, all other considerations being equal, we have this rule: Call the difference between the distance around on a level and that over the hill, d, the distance around being taken as the greatest, and call h, the height of the hill.

Then in case of a first class road, we go around when d is less than 16 h.

And in case of a second class road, we go around when d is less than 10 h.

When the height of a necessary embankment gets to be more than 60 or 65 feet, a bridge or viaduct will be found cheaper, and the same measure, 60 feet, applies in case of tunnels, they being cheaper at that depth than open cuttings.

Under the head of laying out roads, something should be said of their width. Speaking only of such roads as are not apt to turn into streets from their proximity to towns and cities, it is well not to make them too broad, for the less the width, the less the cost of construction and maintenance, and a good 23 feet road is much better than a poor one 40 or more feet wide. Each rod ($16\frac{1}{2}$ feet) in width adds two acres per mile to the road. An agreeable form of road is to have on each, or on one side of the same a strip, 5 or 6 feet wide, sodded, and then a sidewalk equal in width to one-eighth the width of the roadway. The intervening strip above mentioned, is planted with trees and at intervals of 200–250 feet furnishes storage places, 30 or 40 long, for the materials used in the road repairs. The width of first, second and third class roadways may be given as 26, $18\frac{1}{2}$ and 13 feet, with a tendency during the last ten years to have none, except in the vicinity of cities, wider than 24 feet, and the rest correspondingly narrower. In view of the changes constantly going on in this country in the value and settlement of land, it would probably be well always to *lay out* a road 50 or 60 feet wide, but to *build* the road proper of the widths above indicated.

With all these rules and data in mind, the real work of actually laying out the road on the ground and on a map is next in order, and this comes so entirely within the province of the civil engineer, and is a matter requiring so much explanation and study, that it cannot well be introduced within the limits of this treatise. It is in this part of the work that a little skill and labor well spent may be productive of very great saving in the cost of the whole work and it should not be left to the inexperienced or unskilful.*

* Gillispie, in his treatise on "Roads and Railroads," gives two forcible instances of the amount those roads which might properly be called *chance* roads, can be improved by a road-maker of skill and understanding. An old road in Anglesea, England, rose and fell, between its two extremities, twenty-four miles apart, a total perpendicular amount of 3,540 feet; while a new road, laid out by Telford between the same points, rose and fell only 2,257 feet; so that 1,283 feet of perpendicular height is now done away with, which every horse passing over the road had previously been obliged to ascend and descend with its load. The new road is besides two miles shorter. The other case is that of a plank-road built in the State of New York, between the villages of Cazenovia and Chittenango. Both these villages are situated on Chittenango Creek, the former being eight hundred feet higher than the latter. The most level common road between these

Making the Road-bed.

Under this head are included, earthworks, drains, culverts, bridges, stay walls, &c., &c., all matters requiring a special kind of skill to construct properly. The writer believes it impracticable to write a book which shall at once be interesting to and therefore valued by the public, and of value to the professional man, and thinks an attempt so to do results always in a failure in both directions. True to the determination expressed in the introduction, he proposes, therefore, to treat under this head mainly with those parts of the subject in which the public at large is most interested, for example, the data for the cost of earthworks, general information relating to drainage, bridges, &c.

Earthworks.

The basis of all values is the daily wages of a common unskilled laborer, and in the data given below, this figure, whatever it is from time to time and in various places, must be taken as unity, or the standard measure.

The cost of earthworks may be divided into three parts—(1) cost of loosening the earth, (2) cost of transport, and (3) cost of forming the transported earth into the desired shape. The cost of the first part depends materially on the kind of earth to be handled. The cost of the second, mainly on the distance the earth is to be moved.

We find by experience, that in digging and loading or throwing 5–10 feet horizontally with a shovel, we obtain for different materials the results of the following table :—

villages, rose, however more than 1,200 feet in going from Chittenango to Cazenovia, and rises more than four hundred feet in going from Cazenovia to Chittenango, in spite of this latter place being eight hundred feet lower. That is, it rises four hundred feet where there should be a continual descent. The line of the plank-road laid out by George Geddes, civil engineer, ascends only the necessary eight hundred feet in one direction, and has no ascents in the other, with two or three trifling exceptions of a few feet in all, admitted in order to save expense. The scenes of similar possible improvements are scattered all over this and the rest of the States; and these facts are still more or equally to be borne in mind in laying out new roads, where the ounce of prevention may take the place of the pound of cure.

Number.	KINDS OF EARTH.	In Parts of a Laborer's Day's Wages.			Amount to be added for keeping and repairing tools.
		Cost per cubic yard to loosen.	Cost per cubic yard to load in wheelbarrows.	Cost per cubic yard to load in carts or wagons.	
1	Loose earths, which are loam, sand, &c., inclusive of loading,	$\frac{1}{7}-\frac{1}{9}$	–	–	$\frac{1}{20}$
2	Heavier earths, such as sticky clay, which does not readily leave the shovel, &c.,	$\frac{1}{6}-\frac{1}{7}$	$\frac{1}{16}$	$\frac{1}{12}$	$\frac{1}{20}$
3	Earths which must be loosened with a pick before they may be shovelled,	$\frac{1}{4\cdot5}-\frac{1}{5}$	$\frac{1}{16}$	$\frac{1}{12}$	$\frac{1}{15}$
4	Solid banks of gravel or clay, earths containing boulders, &c., in which one man only loosens as much as another man shovels,	$\frac{1}{4}-\frac{1}{4\cdot5}$	$\frac{1}{16}$	$\frac{1}{12}$	$\frac{1}{12}$
5	Same material, worst kind, brick and mortar heaps, earth full of roots, &c., in which it takes two men to loosen what one man shovels,	$\frac{1}{3}-\frac{1}{3\cdot5}$	$\frac{1}{12}$	$\frac{1}{8}$	$\frac{1}{10}$
6	To break up stone which is in layers or seams, requiring the use of the crowbar only, but no blasting,	$\frac{1}{2\cdot5}-\frac{1}{3}$	$\frac{1}{12}$	$\frac{1}{8}$	$\frac{1}{10}$
7	Blasting rocks in an open cut, according to the hardness of the rock, to the position of the seams, &c.,*	$\frac{1}{2\cdot5}-\frac{1}{1\cdot5}-\frac{1}{1\cdot25}-\frac{1}{0\cdot75}$	$\frac{1}{12}$	$\frac{1}{8}$	$\frac{1}{10}$
8	In forming and shaping embankments,	$\frac{1}{25}$	–	–	$\frac{1}{20}$

* To excavate rock to a given line and level, that is, to trim a cutting may cost double these figures per yard.

TRANSPORT OF EARTH.

Throwing with a shovel.—This is to be done only from 5–12 feet in distance or from 5–6 feet vertically. To throw 5 feet vertically, costs as much as 12 feet horizontally, that is to say, if 30 feet horizontally cost per cubit yard, $\frac{1 \text{ day's wages}}{8.4}$ the same distance vertically will cost about $2\frac{1}{2}$ times as much, or more exactly, $\frac{1 \text{ day's wages}}{3.5}$ whence is seen the economy of using windlasses, &c., instead of "stages,"* in shovelling earth vertically. The table gives the cost of shovelling earth certain distances, expressed in the number of cubic yards a laborer's day's wages will pay for.

DISTANCE OF THROW, IN FEET.	Vertical or Horizontal.	Whether done at one operat'n, or by means of so-called "stages."	Number of cubic yards which can be transported at the cost of one laborer's day's wages.	Remarks.
0–10, . .	Horizontally,	No "stages."	23 5	
10–20, . .	"	1 stage.	12.6	Wheelbarrow cheaper.
20–30, . .	"	2 stages.	8.4	
0–5, . .	Vertically,	No stages.	14.1	
5–10, . .	"	1 stage.	8.8	

Wheelbarrows.—The usual distance of transport suitable for the use of wheelbarrows is 100–200 feet. In exceptional cases it may be more, but perhaps never above 500 feet, and then only for moderate quantities. In going up hill, the greatest inclination is to be not more than 1 in 10, and a man can push only $\frac{2}{3}$ as much on this inclination as on a level. 3 feet vertical transport costs as much as 90–100′ horizontally. Whenever possible, planks should be laid for the wheel-barrows to run on. The best timber for this purpose is beech wood and the cost of keeping such planks is only about $\frac{1}{40}$ or $\frac{1}{50}$ per cent. of the cost of transport per cubic yard.

* By a "stage," is meant the operation of one shoveller lifting and throwing what another has thrown in front of him.

Distance of Transport, in Feet.	Number of trips per day of ten hours, made with one man at barrow, and one to load.	Contents of wheelbarrow load in cubic feet.	Number of cubic yards which can be transported at the cost of one laborer's day's wages.
10–20, ...	120	$2\frac{1}{2}$	23.5
20–50, ...	110	$2\frac{1}{2}$	16.9
50–70, ...	100	$2\frac{1}{2}$	14.4
70–100, ...	98	$2\frac{1}{2}$	13.8
100–150, ...	96	$2\frac{1}{2}$	13.3
150–200, ...	94	$2\frac{1}{2}$	12.8
200–250, ...	92	$2\frac{1}{2}$	12.4
250–300, ...	90	$2\frac{1}{2}$	12.0
300–350, ...	88	$2\frac{1}{2}$	11.6
350–400, ...	86	$2\frac{1}{2}$	11.2
400–450, ...	84	$2\frac{1}{2}$	10.9
450–500, ...	82	$2\frac{1}{2}$	10.5
500–550, ...	80	$2\frac{1}{2}$	10.2

Patent Portable Railroad and Hand Cars.

These have lately been introduced in this country and appear to be coming into general use and favor. The company owning this improvement, as it seems to have a right to be called, claim, that by means of their track and cars, which can be used everywhere that a wheel-barrow or a horse-cart can go, and in a great many places where these vehicles cannot go, they effect a very large saving, as much in some cases as $\frac{5}{6}$ of the cost by the other means of transport. There are no data published as yet to make tables from similar to the foregoing; from the company's pamphlet, however, one given case which occurred on Staten Island in 1867, may be analyzed and tabulated as follows:—

Distance of transport, in feet, ... 550

Number of trips per day of ten hours, with one man at two cars, and two to load, ... 150
Contents of car, in cubic feet, ... 11.34
Number of cubic yards which can be transported at the cost of one laborer's day's wages, ... 60

One-Horse Carts.

The table for this kind of transport may be stated about as follows. 1 foot vertical costs as much as 14 horizontal.

Distance of Transport, in Feet.	Number of trips made per day of ten hours, assuming only four minutes to load, dump, &c., per trip.	Contents of cart load in cubic feet.	Number of cubic yards which can be transported at the cost of a laborer's day's wages.
300, ...	86	8	17.1
500, ...	67	8	13.6
1,000, ...	43	8	8.6
1,500, ...	31	8	6.4
2,000, ...	25	8	5.0
2,500, ...	21	8	4.3
3,000, ...	18	8	3.6

Ox-cart transport is 10 or 12 per cent. cheaper than the above, but takes more time.

Other methods of transport, such as horses or engines on temporary tracks, would hardly ever be applied to road-building, but belong more properly under the head of railroad construction.

Shrinkage.

In calculating the cost of earthworks, the so-called shrinkage of earth must not be overlooked. Earth occupies on the average $\frac{1}{10}$ less space in embankment than it did in its natural state, 100 cubic yards, shrinking into 90. Rock on the contrary, occupies more space when broken, its bulk increasing by about one-half.

The shrinkage of gravelly earth and sand may be taken at 8, of clay 10, loam 12, surface soil 15, and of "puddled" clay 25 per cent. The increase of bulk of rock is 40 to 60 per cent.

To make use of all these data in calculating the probable cost of a piece of road, there is of course still wanting the equally essential factor which gives the number of cubic yards to be dug and moved and the distance of transport. These are got from the plan, profile and cross-sections of the proposed work, an engineer's knowledge being requisite to make the necessary drawings and calculations.

Drains and Culverts.

The drainage of roads is of two kinds, surface and sub-drainage. The first provides for a speedy removal of the rain-fall on the surface of the road and the cutting and embankments on which it is carried; the second, for the removal of that part of the rain-fall which nevertheless does penetrate into the body of the road-covering. With a perfect sub-drainage the winter's frost, having no water to act upon within the body of the road, is robbed of its great power to destroy the same, and it also prevents the road-surface from becoming soaked and thence destroyed in the summer. The need of surface drainage is self-evident. This last named is to be provided for at this stage of the building of the road, the sub-drainage being more properly a part of the building of the road-covering or top. For this purpose ditches, one on each side generally, are absolutely necessary, both when the road is on a level with the surrounding country and when it is in a cutting. They may become necessary also in the case of embankments; for example, when an embankment is built across low ground. Where these side ditches cross under the embankment we have a culvert; also whenever any small valley, having a constant or intermittent stream of water, is crossed by such an embankment. It is very bad policy to make such culverts of wood, unless indeed they are so situated as to be constantly under water; the cost of replacing them after the embankment and road has been built over them is disproportionately great. They should be made of stone, or brick; lately, cement drain-pipe, oval or egg-shaped, has been used to advantage in their construction.

All ditches, drains and culverts should have a fall throughout

their entire length. Their size will depend on the amount of water they may be expected to carry and this again on the rainfall that may occur on the area which they drain. Extraordinary showers have occurred of 2″ in half an hour but only over a very limited area and 2″ in an hour may be taken as a large allowance. This is the basis of the Central Park drainage calculations and is larger than usually taken, none too large however for safety. As culverts grow larger and wider with the amount of water they are to pass under the road, they develop finally into

Bridges.

Bridge-building is a life's study, taken by itself, and in some of its parts it is not half appreciated and known as yet among the public. Prominent among these is beauty of design and *appropriateness to the situation.* There is perhaps nothing else that will so much improve the appearance and attractiveness of a road as a beautiful bridge. So also in cities we find that a street will of its own accord, seemingly, improve in appearance, when a good and handsome bridge has been erected on its line, the owners and builders of the adjoining buildings taking the bridge for their pattern and model. Nor must it be supposed that a handsome bridge must necessarily cost more than an inappropriate or homely, uncouth structure; it need never be the case. Very often the chief beauty of a structure lies in the fact of its carrying the most with the least expenditure of material. No one bridge is proper in every situation and herein are many mistakes made. The correct way to build a good bridge, is the same or a similar way to that followed in first-class buildings, namely, to have plans drawn for the same and receive estimates and offers to build according to these plans. It is not well to allow the offices of designer, superintendent and contractor to be united in one person or firm, and is expecting too much from human nature.

Making the Road Surface.

There are two subordinate kinds of road surface, if the term road can properly be applied to them, namely, that of foot and riding paths; these may be disposed of first, before proceeding to the more important consideration of the road surfaces proper, those used by vehicles of all descriptions.

Footpaths.—For the surface of a footpath little solidity is necessary, except in city sidewalks which are not supposed to be treated of here, but we do need a material that shall become and stay compact soon after it is laid. Coarse sand, screened gravel, stone chips and dust, make good paths; should these materials be too free from any earth or clay, a little of the same may often be added to advantage to act as a binding material. Wherever the ground underneath the surfacing is not porous or likely to remain porous enough to let all the water that may soak through, drain away, a layer of such porous material must be filled up before the top surface is put on. Oyster shells, or large stone chips, gravel stones or pebbles, &c., make a good foundation of this sort. The top covering should have a slope, best in both directions from the centre of the path towards each side of about 1 in 16; the thickness of the foundation course to be 3–5, and that of the top 3–4 inches. *Heavy* rolling will save much time in finishing the whole process; the roller should be used unsparingly and throughout the whole construction of the path, on the foundation, as well as on the top.

Riding-Paths.—From the nature of the travel these are intended to accommodate, their surface is of a peculiar nature. Inasmuch as a horse, in galloping, tends to throw the soil he treads on backwards with his hind feet, the surface must be kept somewhat loose and soft to make riding on it easy and agreeable. This requirement makes it impossible to have any slope on the surface (the loose material would wash away if there were any), and hence we must rely here wholly on sub-drainage, and not attempt any surface drainage. The top is made of coarse sand, *free from clay* or other binding material, laid on two and one-half to three and one-half inches thick, and spread out level. Under this is a solid foundation, about four inches thick, made of coarse gravel and clay, and having a slope of about 1:20, so that the water will run off along its top surface to either side, where it must further be disposed of by drains or ditches. In case of riding paths too wide to be so simply built, the sketch shows the method to be used. The

foundation is made in several slopes, at the lowest parts of which are placed drains, running in the direction of the path,

but communicating from time to time with the side ditches or drains. Should, however, the ground underneath be porous enough, the drains may be dispensed with; and if in their stead holes be dug along the lowest lines, marked *a*, *a*, and these filled with large stone, the water will, through them, drain away into the ground.

Roads.—To make a good road surface is a very simple operation after it is only once understood, and, the fundamental principles thereof once comprehended, they can hardly be forgotten. Everything connected with the construction, the use and maintenance of roads, was, in times past, before the invention of railways, the subject of exact observations and experiments, many and varied in their character. Besides this, we have the results of a great number of years of experience in older countries, and there would seem to be little to invent, but much to learn, in this branch of construction. Though less progressive than other branches, there are nevertheless improvements in road-making, especially in road-making machinery and tools; and no treatise on this or any other living subject can be considered complete a very few years after it is written.

Ancient roads were made with a surface as nearly resembling the solid rock as possible. So, in China, roads were made of huge granite blocks laid on immovable foundations. In time these became worn with ruts, especially in the joints or seams of the stones, and the surface generally so smooth that animals could hardly stand, far less trot on it. They are now for the most part deserted, and left to be covered up by land-slides, &c., to one side of the new roads of travel.

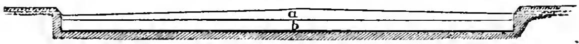
The invention of McAdam consisted in having no large stone at all on the roadway, but having it all pounded into small fragments and spread over the road-bed. This has, without fear of efficient contradiction or shadow of doubt, been proved by trial to be a worthless proceeding, though at one time popular, and even now only too often done, either from ignorance or laziness. The separate fragments of stone, having no bond among themselves, are liable to sink into the underlying ground or road-bed, evenly or unevenly as it may chance, more in one place than in another, and thus never come to rest or to an even top surface. Between these two extremes of an ancient Chinese solid rock road and that of McAdam, lies the true principle of

road-making, which consists in giving every road two component parts; one,—the foundation,—to be solid, unyielding, porous, and of large material; the other—the top surface—to be made up of lighter material, and to be made to bind compactly and evenly over the rough foundation. This constitutes the whole principle to be followed; and let it be repeated, that to dump the road material directly on the ground, without first preparing a foundation for it, as is so frequently done, is a waste of time, labor and materials, by no possibility resulting in a good road. On this one fundamental idea, which is never abandoned, however, there are a number of variations. Besides these roads, whose characteristic is the foundation they are all built on, we have paved roads, or pavements, of a great many kinds, and roads with trackways, also of various kinds.

Foundation Roads.

The roads of this kind, with macadam for the top surface, are called Telford roads by English writers, from Telford, who first built them in England. The Central Park "gravel roads" belong under this head, gravel taking the place of the macadam of the Telford roads. These foundation roads are of far greater importance than any other kind for State, county or town roads, also for parks and driveways. The top surface of all these roads must have a certain inclination, to cause efficient surface drainage. Various authorities give various rules for the amount of this inclination or side-slope. It would seem just that it should depend on the nature of the top covering, being less for more solid than for looser or softer materials, and also on the grade of the road.

In Baden, one of the smaller German States, but which is worthy to be taken as a model in matters of road-building, and in France, the rise at the centre is given as $\frac{1}{40}-\frac{1}{60}$ of the width of the road, according to the nature of the material; that is, inclinations of 1 in 20, and 1 in 30. The rules in Prussia prescribe inclinations of 1 in 24 for roads falling more than 4 in a hundred; 1 in 18 for roads on a grade of between 2 and 4 in a hundred; and 1 in 12 for those on a grade of less than 2 in a hundred. When first built, the centre should be made some four inches too high, to allow for after settling.

Macadam Top.—The cross section of such a road is about as drawn; 

the thickness of the foundation $b=a$, the thickness of the top covering at the centre, and is six, four or five and three and one-half inches in thickness for first, second and third class roads. If the stone for the foundation—for which most anything will do, and that kind should be taken which is cheapest to procure—happens to be got out cheapest in larger pieces than the above dimensions, it will do no harm. This foundation course is sometimes set so as to present an inclination on top, and the cover then put on of a uniform thickness over the whole breadth. This is perhaps best, but is somewhat more expensive. It will do, in nearly all cases, to set the foundation course on a level, or as near so as the stones will allow, and then make the top crowning, by making the covering say three-quarters of an inch or an inch less thick at the edges than in the centre. The stones forming the foundation should not be set in rows, nor ever laid on their flat sides, but set up on edge and made to break joints as much as possible; that is, set up irregularly. After they are set up, the points that project above the general level may be broken off, and the interstices generally filled with small stone. More or less care and work are necessary in this part of the operation, according to the importance of the road and the depth and character of the material used for the top covering. To roll the road at this stage is to be recommended; afterwards it becomes a requisite. The point never to be lost sight of, is that this foundation course must remain porous, must be *pervious* to water, so that all rain-water that shall soak through the top covering will find, through it, means of escape to the ground underneath; thence, according to the nature of the subsoil, it is left either to soak into the ground, or must be further led away by appropriate drains.

Of very great importance is the *material* used for the top or road covering. In the order of their value for macadam, we have.

I. Basalt.
II. Syenite and Granite.
III. Limestones.
IV. Sandstones.

It will be evident, that a very much greater quantity of the soft stones would be required to repair a certain road, than of a harder kind, and on a road lying out of the way of a hard stone quarry or deposit, the question will arise which is cheapest, to pay more for the raw material and get good stock, or pay less and use the worse. There have been some interesting results in places where this matter has been the subject of experiment, continued for a number of years. Thus on a road in Baden which was formerly macadamized with rock costing only fifty cents per cubic yard, it was finally found cheaper, to take harder rock from a distance costing one dollar and seventy-eight cents per cubic yard, the saving being both in less *quantity* of material used and less *labor* required in repairs. Just where the limit is, must be found in each case by long continued experiment, which it is well worth the trouble to make, both to save expense and also to have the best possible road, the harder material making a road better at all times, at the same or less cost. After the right kind has been determined, none other should be mixed with it, and should any inferior piece accidentally or designedly get into the stock to be broken up, it should be picked out and thrown aside. The stone is broken up into macadam, either by hand or machinery. Wherever any considerable quantity of macadam is in present or future demand, a stone-breaker is certainly a saving over hand-labor, though it is difficult to draw the line exactly, where hand-labor or machine labor is cheapest. Probably no town that pretends to keep thirty or forty miles of road in good repair, ought to be without one of these labor-saving machines. Those most in use are made by Blake Bros. of New Haven, Conn., and the following is taken from their circular.

Their machine has been patented in the United States and in several foreign countries, and is now in use in almost every country on the globe. It is simple and compact, and being complete in itself, requires no extraneous support or fixtures.

Description.—Figure 3, is a perspective view of the machine, entire. The frame A, which receives and supports all the other parts, is cast in one piece, with feet to stand upon the floor or on timbers. These feet are provided with holes for bolts, by which it may be fastened down if desired; but this is unnecessary, as its own weight gives it all the stability it requires. B,

B, are fly-wheels on a shaft which has its bearings on the frame, and which between these bearings, is formed into a short crank.

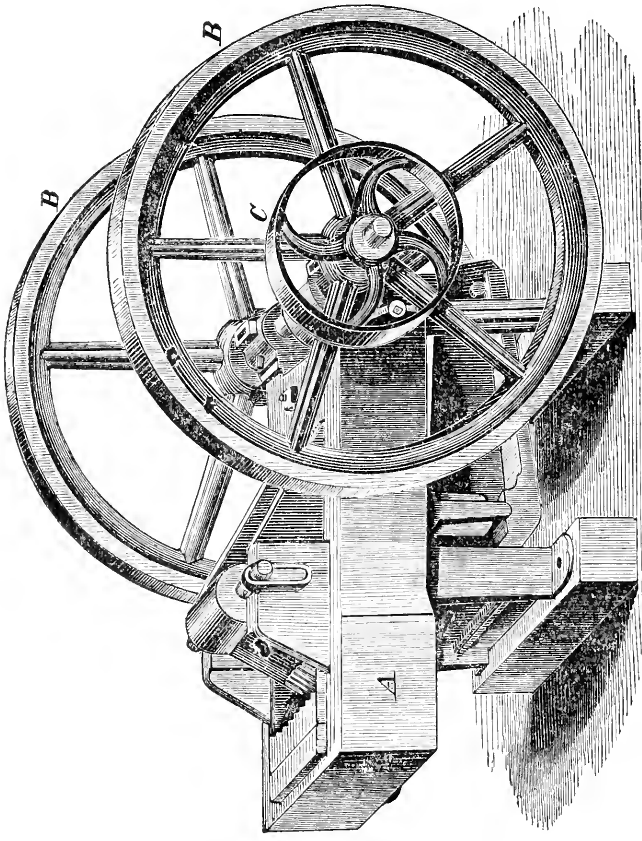


FIGURE 3.

C, is a pully on the same shaft, to receive a belt from a steam-engine or other driver.

Figure 4, shows a side view or elevation of the other parts of the machine in place, as they would be presented to view by removing one side of the frame. The parts of this figure which are shaded by diagonal lines, are sections of those parts of the frame which connect its two sides, and which are supposed to be cut asunder, in order to remove one side and present the other parts to view. The dotted circle D, is a section of the fly-wheel shaft; and the circle E, is a section of the crank. F, is a pitman or connecting rod which connects the crank with the lever G. This lever has its fulcrum on the frame at H. A vertical

piece I, stands upon the lever, against the top of which piece the toggles J, J, have their bearings, forming an elbow or tog-

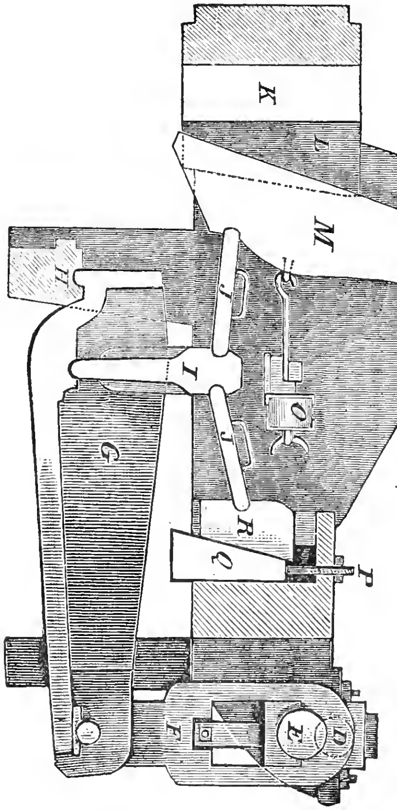


FIGURE 4.

gle-joint. K, is the fixed jaw against which the stones are crushed. This is bedded in zinc against the end of the frame, and held back to its place by cheeks L, that fit in recesses in the interior of the frame on each side. M, is the movable jaw. This is supported by the round bar of iron N, which passes freely through it and forms the pivot upon which it vibrates. O, is a spring of india-rubber, which is compressed by the forward movement of the jaw and aids its return.

Every revolution of the crank causes the lower end of the movable jaw to advance toward the fixed jaw about $\frac{1}{4}$ of an inch and return. Hence if a stone be dropped in between the convergent faces of the jaws, it will be broken by the next succeed-

ing bite ; the resulting fragments will then fall lower down and be broken again, and so on until they are made small enough to pass out at the bottom. The readiness with which the hardest stones yield at once to the influence of this gentle and quiet movement and melt down into small fragments, surprises and astonishes every one who witnesses the operation of the machine.

It will be seen that the distance between the jaws at the bottom, limits the size of the fragments. This distance, and consequently the size of the fragments, may be regulated at pleasure. A variation to the extent of $\frac{5}{8}$ of an inch may be made by turning the screw-nut P, which raises or lowers the wedge Q, and moves the toggle-block R, forward or back. Further variations may be made by substituting for the toggles J, J, or either of them, others that are longer or shorter ; extra toggles of different lengths being furnished for this purpose.

This machine may be made of any size. The builders have patterns for several sizes, and are ready to make others as called for. Each size will break any stone, one end of which can be entered into the opening between the jaws at the top. The size of the machine is designated by the size of this opening ; thus, if the width of the jaws be ten inches, and the distance between them at the top five inches, we call the size ten by five.

The product of these machines per hour, in cubic yards of fragments, will vary considerably with the character of the stone broken. Stone that is *granular* in its fracture, like granite and most kinds of sandstone, will pass through more rapidly than that which is more compact in its structure. The kind of stone being the same, the product per hour will be in proportion to the width of the jaws, the distance between them at the *bottom* and the speed. The proper speed is about one hundred and eighty revolutions per minute ; and to make good road metal from hard compact stone, the jaws should be set from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches apart at the bottom. For softer and for granular stones, they may be set wider.

The following table shows the several sizes of machines for which patterns are on hand,—the product per hour of each size, of fine road metal from the hardest materials when run with a speed of one hundred and eighty,—the power required to perform this duty, the whole weight of each size, in round num-

bers, and the weight of the heaviest piece when separated for transportation :—

SIZE.	Product per hour.	Power required.	Total Weight.	Weight of Frame and parts attached.	Cost, Jan'y, 1870.
10×5, . .	4 cubic y'ds.	6 horse,	6,600 lbs.	3,200 lbs.	$800 00
10×7, . .	4 "	6 "	7,600 "	4,100 "	900 00
15×5, . .	6 "	9 "	9,100 "	4,700 "	1,050 00
15×7, . .	6 "	9 "	10,200 "	5,600 "	1,200 00
15×9, . .	6 "	9 "	11,600 "	6,800 "	1,250 00

Since steam-engines, as usually rated by their makers, do not work economically to more than one-half their given horse power, an engine of double the power given in the table had best be bought.

The whole length of the machines to the backside of the wheels, is from eight to eight and one-half feet; height to top of wheels, five feet; width, from four to five feet.

The machine may be driven by any power less than that given in the table, yielding a product per hour smaller in the same proportion.

The proper sizes for making macadam, are the fifteen by seven and fifteen by nine for towns and parks. Public institutions and others requiring less quantities to be got out, can use the ten by seven size.

When broken by hand and for country roads, the stones should be broken on the storage places already mentioned, which are to be established along the side of the road every 200–250 feet. The laborer is not to pound the stones on a heap of such, but to use one large stone as a sort of anvil to break the others on. He is to use a light hammer, except for pieces containing more than four or five cubic feet, and may use a ring with a handle attached to hold the stone he desires to break.

In order that the road shall get an even surface the macadam must all be of one size, and the proper size for the macadam depends on the degree of hardness of the rock. If too small it

turns to dust, if too large the top will not pack even. The size is regulated by the use of a ring as a gauge,—every stone being obliged to be capable of falling through this ring in any direction it may be dropped. Hard stones should be one to one and a quarter, softer ones one and a half and the softest two inches in diameter. Larger sizes give less perfect roads. In loading and otherwise handling macadam, a many and close-pronged pitchfork should be used instead of a shovel, so as not to mix in any earth or sand and to sift out the stone dust and chips.

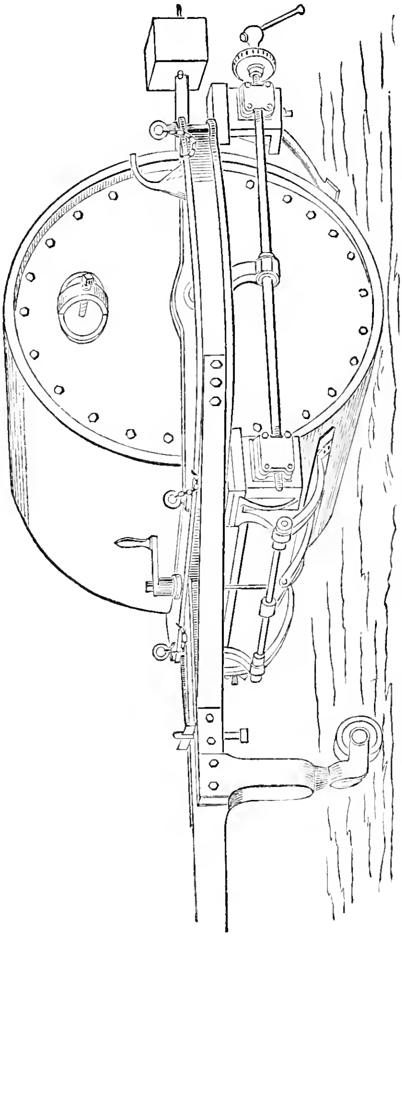
The macadam being properly prepared and loaded up, it is spread over the foundation in two or three successive layers. Each layer *should* be rolled, but the top and last one *must* be rolled to make a good road. Nor will rolling alone do the work. Two other helps are needed: the use of a binding material, to act as a cement between the broken stone, and sprinkling. It is difficult to prescribe in words just what to use as binding material and just how much to sprinkle and roll; common sense will in most cases be a safe enough guide. In the macadamized streets of Paris the rule is to roll till a single piece of macadam placed under the roller, will be crushed, without being pressed into the road surface. Gravel somewhat mixed with clay by nature, but not too much, is probably best as a binding material. Clean coarse sand is very good. Other substances will do, where it would cost too much to procure either of the above.

The subject of rollers is one demanding some attention. In general, people are apt to over-estimate the value of a roller with respect to its weight. It will be evident on reflection that a roller should be as heavy per inch in length of roller, as a loaded wagon wheel is per inch of tire; or in other words, if we have a wagon with tires two and one-half inches wide and on each wheel a load of say one ton, the roller should weigh two-fifths ton for every inch in length, or a roller three feet long should weigh about fourteen and one-half tons, or else a wagon as above described would exercise more pressure on the road-bed per square inch than the roller and consequently would cut into the rolled surface and produce ruts. Road-rollers are of two principal kinds: those pulled by horses and those propelled by steam. The latter are for many reasons the best. In the first place they can be made as heavy as desired, without proportionally increasing the cost of propelling them, and being self-pro-

pelling, the only track they make is that of the roller, whereas with horse rollers, the hoof-marks of the horses are a great objection. Then again in the amount of work they will do at a certain cost, they excel horse rollers. They may be briefly described as a sort of locomotive mounted on three or four very broad and heavy wheels, these latter being the road-rollers.

There are several varieties in use in France and England and two at least of the English kind have been imported into this country, one for the New York Central Park, the other for the Arsenal Grounds in Philadelphia. The cost of the Central Park steam road-roller made by Aveling & Porter of Rochester, Kent, England, was about $5,000, set up in New York, and the amount of work it will do in one day at a running expense of $10, has been given as equal to that of a seven-ton, eight-horse road-roller in two days at $20 per day, or in other words, it will do the same work at one-quarter the running cost and in one-half the time, of a first-class horse road-roller.

The best horse road-roller of which the writer has any cognizance is the one shown by the annexed drawings in plan, elevation and in perspective. (See pp. 230–2–4.) It originates in Chemnitz, Germany, but can of course be easily made by any machine-shop or foundry. The hollow roller is made of cast-iron and is so arranged that it may be filled with water when it is to be used in heavy rolling; when not in use and about to be moved from place to place, the water is allowed to run out, thus materially lessening the load. A circular cast-iron frame A, surrounds the roller, and carries the axle bearings of the same. The outside of this frame is turned to form a groove in which a strong wrought iron ring is fitted in such a manner that it will turn easily around the former. This wrought iron ring consists of two semi-circular parts, at whose junction the pole is attached on one side, and on the other an extension bar, carrying the balance weight *c*, which may be shifted by means of the set clamp *d*, or turned up by means of the hinge *b*. Pins going through the holes at *e*, fasten this ring or allow it to be turned for the purpose of pulling the roller in the contrary direction, when desired. The brake is shown at *f*, *f*, and consists of four wooden brake-blocks, attached by iron shoes to a bar behind them and having rubber packing between the shoes. The screws shown and the handles *h*, are used to operate these brakes.



CIRCULAR FRAME HORSE ROAD-ROLLER.—Perspective View.

The cranks *m*, working the screws *n*, operate the scrapers *l*, which are used to keep the roller clean in muddy weather. The frame A, is made heavier at *o*, so as to have increased weight there to balance the whole frame-work in turning around. The support *p*, and the guide wheel *k*, might be dispensed with. A great saving in time and in movements hurtful to the road is effected by making the frame circular as described, this allowing the roller to be turned with the greatest ease. The dimensions are figured on the drawing. A roller of this kind four and one-half feet in diameter and three and one-half feet long, and weighing some four tons when empty, would cost perhaps \$560–\$600; one 5 feet × 3′ 8″, weighing about five and one-quarter tons (empty,) some \$700–\$750. Leaving off the break would diminish the cost about \$50.

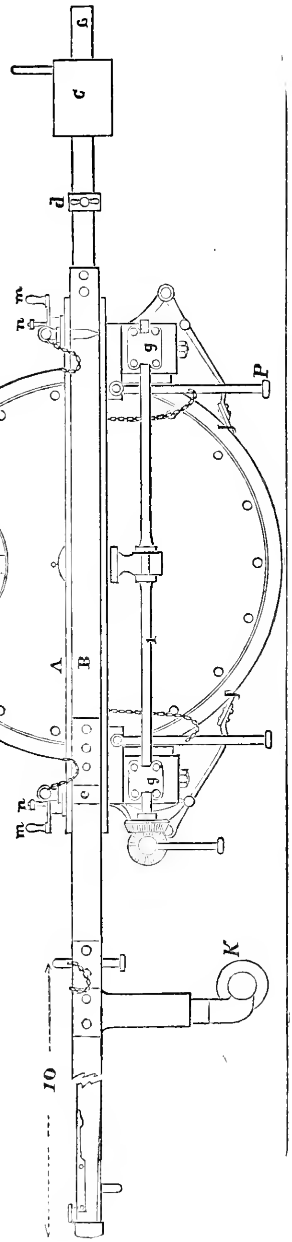
Before leaving the subject of macadam top roads, it ought to be mentioned, that a bed of rubble stone 10″ or 12″ deep, merely spread uniformly over the road-bed as a foundation, is better than nothing at all, but can never make the same quality of road as the rough paving described above.

The following data are to be used in estimating the cost of the kind of road just described. Rough foundation paving, pieces 5″–6″ long, filling up crevices and ramming the whole with hand rammers, costs after the material has been brought to the spot, one day's work of a common laborer for every four square yards, this assuming that the paver gets one and two-thirds common laborer's wages. Same kind of paving if set in sand will cost one day's work of a common laborer for every two and one-quarter square yards.

To make macadam by hand costs, for sizes from $1\frac{1}{4}$–$1\frac{1}{2}$″ of very hard rock, one day's work for every 0.6–0.44 cubic yards, for less hard rock, one day's wages will make 0.7–0.6 cubic yards, and of soft rocks 1.76–1.17 cubic yards.

To spread 14–12 cubic yards of macadam is also about a day's work.

Gravel Top.—Instead of the macadam top described in the preceding articles, screened gravel may be used. These roads are the favorite ones in Central Park, New York, and are probably the best road there is for pleasure drives. It is a matter of some doubt yet whether they do as well for heavy trucking as they do for light vehicles. The foundation for these gravel roads

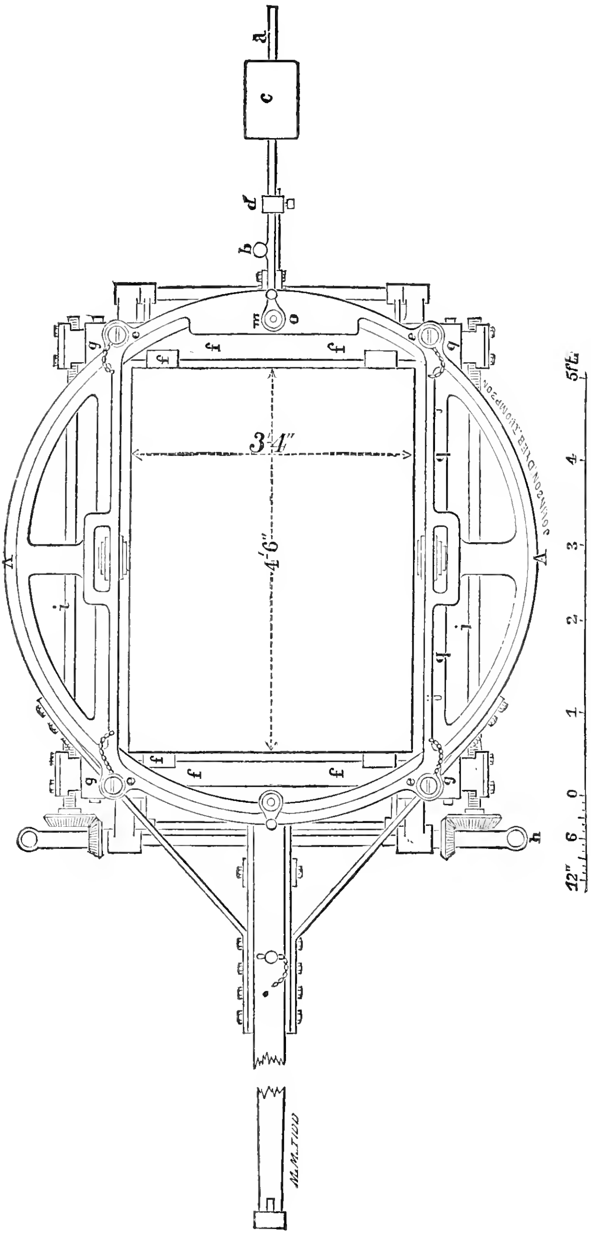


CIRCULAR FRAME HORSE ROAD-ROLLER.—Elevation.

should be the same as the rough paving for the macadam road; some pieces were built in the Central Park, having a rubble stone foundation but they are not recommended by their builders. The gravel to be used for the top must be selected with some care; it should be of a hard kind of stone, clean, that is, free from clay, &c., of the right color, &c. It is put on in two layers, each rolled, and the top one made compact and firm, by spreading and mixing in some good binding material, sprinkling and rolling. There need be no fear of making a poor road by using the smoothest, most water-worn pebbles, free from all sand, &c., in making a road-top. The upper portions of the river Rhine are remarkable for the clean, smooth pebbles that form its bed to a very great depth. These pebbles are dredged up and used in road-building, making an excellent road-covering at a small expense. There are many miles of such roads in Baden and in the Bavarian Rhine Provinces.

Keeping Roads in Repair.—This subject properly finds its place here, being a matter of skill and a thing of debate only in the case of what we have called foundation roads; pavements and trackway roads, to be considered after this, need no special directions as regards their repair or maintenance.

After a road has been properly rolled, and the surface made compact and smooth, it should always be maintained in that condition, no matter how great is the amount of travel on it. "A stitch in time saves nine," here as well as elsewhere. The tendency is to produce ruts; these gather water; this soaks up the road-bed and spoils the whole. The problem can be put in this way: To have a good road, it is necessary that there be no dust or mud on the same, and that there be no ruts; therefore remove the dust and mud as fast as they are formed, and fill up the ruts as fast as they are made. The whole matter is here in a nut-shell. It may be thought, at the first view, that this is too expensive a system. Its principal beauty lies, however, in the fact that it costs less per mile of road kept one year than the pernicious system of annual or semi-annual repairs, as will be shown and proved. The above two rules—sweep off the mud and dust as fast as they are formed, and fill up the ruts and bad places with new material as fast as they appear—are all that is necessary to be carried out in order that there be *continually* a good road. Without continual repairs, there can be no



CIRCULAR FRAME HORSE ROAD-ROLLER.—Plan.

such thing as a constantly good road—a proposition that cannot too often be repeated. By repairing a road annually, or twice a year, it matters not which, the result is, strictly speaking, a *good* road at NO time during the whole year. The road is wretched just after repairs; it becomes *passable* after a while, and deteriorates from that day forward, until it is again made wretched; and so on, *ad infinitum*, according to the present only too commonly followed system. By the other method is offered us a road as smooth as a floor, year in, year out, and, let it not be forgotten, *at a less expense.*

A French engineer, named Trèsaguet, was the first, in 1775, to call attention to this proper method of making road repairs. His system—the above described one—was adopted in Baden in the year 1845, and has been long in universal use in all the active European countries. The two tables below give, the first, the actual average quantity of road macadam used per mile of road in Baden to make the repairs in one year, and show the decrease after 1845. The second gives, in the first column, the cost of materials and labor required to repair one league for one year according to the old way,—this column being calculated for the years following 1845 from the cost of the preceding years, and allowing for the increased value of labor and materials,—while in the second column we have the actual cost, as it was with the system followed at the time:—

TABLE I.

YEAR.	Cubic yards used per mile in one year to repair roads.
1832,	218.6
1839,	198.7
1851,	127.2
1855,	91.4
1856,	89.4
1860,	93.4

TABLE II.

YEAR.	Cost of Repairs of one league of Road.	
	By old way of so doing, in florins.	By system of continual repairs, in florins.
1835, ...	1,002	1,002
1840, ...	1,086	1,086
1845, ...	1,170	$975\frac{36}{60}$
1850, ...	1,254	$965\frac{40}{60}$
1855, ...	1,339	$835\frac{5}{60}$
1860, ...	1,423	$978\frac{54}{60}$

These figures are taken as given by the chief engineer of the Baden Public Works, Mr. Keller. He quaintly adds: "These tables give clear evidence in favor of the reduced *cost* by the adopted system. That roads are *better* now than they formerly were, everybody knows." Another German engineer expresses himself to the same effect in a little different way. "It costs no more," says he, "to keep the roads in repairs now (1864,) than it did twenty years ago, when this method (of continual repairs) was not in use, although labor is now three times and materials are twice as dear as they then were." There seems to be no doubt of the superiority of the continual repair system in every respect, producing very much better roads, and at the same time costing less. It need only be tried with us to be thenceforth adopted.

How to Repair Roads on the Continuous System.

We suppose the material for the road-covering to lie in regular measured heaps, all ready to be used, at the storage places, once or twice above mentioned, as being 200–250 feet apart alongside of the road, but not encroaching upon it. Then, for every two or three miles of road, a so-called road-keeper is employed to do the necessary work and repairs. An enumeration of his duties will comprise at the same time an essay on the art of road repairing.

1. The road-keeper is to remove the dust formed in dry weather by sweeping with a brush broom. This is done to greatest advantage just after a slight shower. In muddy weather, it is essential that the mud be removed by means of brooms or hoes. A little mud on the surface causes ruts, and much mud softens up the whole road-surface. The mud is to be raked up in heaps alongside of the road, there left to dry and then carted off. To hinder as much as possible the formation of any mud, the surface drainage must remain unimpaired; should it be out of order, the water standing on the road is to be swept off. To diminish the wear of the road in dry times, the road should be sprinkled.*

2. Inasmuch as the covering gradually wears off, notwithstanding all precautions, it must be renewed, and should be so renewed gradually, in the same measure as it wears off. The best time to put on new road metalling is during continuous wet weather.

3. In filling up holes, the bottom of the same is to be swept clean of mud, then filled up level with the remainder of the road, not in a heap so high above it as to obstruct travel.

Every care should be taken to have the new material join as speedily as possible with the old portion of the road, and it should be so well laid that it will give the least possible hindrance to vehicles, which will then not avoid the patched places.

4. When many ruts occur in a short distance, the deepest only are to be filled at first. After the patching in these has become solid, then the rest are to be attended to. Long ruts or wheel tracks are not to be filled up the whole length at once, but only short pieces at a time. If this precaution is neglected, vehicles avoid such places, and new ruts are formed elsewhere.

5. Inasmuch as more material is worn off in a dry season than can be put on, there are then, when wet weather comes, large places to be repaired. These must be mended by degrees, never filling up a piece larger than 8–10 feet × 4–7 feet, at a time and not having these pieces too near together; when these have

* Bowles, in his book, "Our New West," mentions the case of the stage road from Sacramento to Virginia City, *via* Placerville, one hundred and fifty miles long, and having an annual traffic of seven or eight thousand heavy teams, and whose proprietors found that the simplest and cheapest way of keeping it in repair during dry weather was to sprinkle the whole of it,—one hundred and fifty miles of mountain road.

become solid, then some more may be fitted in and so on till the whole is done.

Should it however become absolutely necessary to repair a piece of road in dry weather, the place where the new macadam is to be deposited must be loosened up with a pick, then the new material put on and a solid top formed by the judicious use of stone dust or other binding material and sprinkling with water and pounding down with the shovel, or by what may be called "puddling" until the whole be solid. Should a frost or very dry weather occur immediately after macadam has been put on the road in wet weather so that the same will not join on the rest of the road surface, the whole must be removed, cleaned and returned to the storage heaps for future use. A layer of macadam over the whole road should never be put on, without treating it immediately afterwards in the manner described above for building new roads, that is, mixing in binding material with the top course and rolling it in wet weather or after sprinkling.

The road-keeper is naturally also the person to see to the proper delivery on the part of the contractors, if such there be, of the road material in the prescribed places and to attend to the measuring of the same.

In short and to sum up, it is his business to keep the road in good order, and with proper men and surveillance the desired result is achieved easily and at a less cost, than by any other system. The quantity of macadam required to keep a certain length of road in repair varies very much; it depends as we have seen on the care with which the repairs are made, naturally also on the kind of stone used and on the amount of travel over the road. For a width of road=twenty feet, the average quantities required per year to keep a length of ten feet in repair, on the system of continuous repairs, has been given as follows:—

	Cubic ft.		Cubic yds.
1. Good material and heavy travel,	15–20	=	.55–.74
2. Good material and medium amount of travel,	10–15	=	.37–.55
3. Good material and light travel,	5–10	=	.18–.37
4. Medium material and heavy travel,	20–25	=	.74–.92
5. Medium material and medium amount of travel,	15–20	=	.55–.74
6. Medium material and light travel,	10–15	=	.37–.55
7. Third rate material and heavy travel,	25–30	=	.92–1.01
8. Third rate material and medium amount of travel,	20–25	=	.74–.92
9. Third rate material and light travel,	15–20	=	.55–.74

These are the quantities as given by one authority, but from a comparison with the amounts actually used during a period of ten years on thirty-nine roads, having very various amounts of travel upon them and being repaired with all kinds of road metal, it would seem that the above figures are very ample.

Repairs of Macadamized and much frequented Streets in Cities.

In this case, where the amount of travel in one day is often greater than that of a month or more on the town road, the system of continuous repairs ceases to be the best available, on account of the incessant throng of vehicles not giving any repaired place a chance to become solid before it is again ploughed up and scattered. Thus in the city of Paris on the Boulevards, &c., the continuous system has been abandoned and the practice now is to let the street gradually wear down three to four inches, then close half of it (divided "fore and aft") to travel, loosen it all up with picks and put on a layer three or four inches [best not to put on more than that] spread a thin layer of sand over this, sprinkle and roll heavily. It often happens that the men put too much of the sand on; in that case, the road, after it is all done, is finally well watered and the roller again passed over it a number of times. This operation causes the superfluous binding material to come to the surface in the shape of thin mud and leaves the road covering as hard and smooth as mosaic, making a most excellent drive-way. It emits a sonorous, ringing sound on being driven over and remains clean and without mud throughout the heaviest rain-storms. The rolling of the streets in Paris, is done by a company owning a large number of steam rollers; in paying them for work done, the city was obliged to go back to first principles for a measure of such work, it being found impossible to estimate correctly by the square measure of surface rolled to such and such a degree of hardness. The measure adopted is that of weight multiplied into the distance it has been moved, or "feet pounds" as we should say. It has been found from many years experience that to roll one cubic meter of macadam requires 4–5 "Kilometer-tonnes" and this is true whether the layer of macadam be three and one-quarter or ten inches thick. Expressed in our measures this is 11,020–

13,775 feet tons @ 2,000 lbs.=2.09–2.61 mile tons per cubic yard of macadam.

Pavements and Trackways.

No essay on roads would be complete without some mention of these two species of road-surface, though the use of the former is confined principally to streets, and that of the latter is out of date.

Pavements are either of stone, wood, iron, various concretes, asphalt, and may be of still other substances.

Stone Pavements.—The modern sizes of paving stones may be seen from the following cases. The Boston size is $4\frac{1}{2}'' \times 3\frac{1}{2}'' \times 7''$ deep; New York Belgian, $6–8'' \times 5–6'' \times 6–7''$ deep; new Broadway pavement, also called Guidet pavement, $3\frac{1}{2}–4\frac{1}{2}'' \times 10–14'' \times 7\frac{1}{2}–8\frac{1}{2}''$ deep. This last is laid with the long sides of the stones across the street; and, as far as the author's judgment goes, is the best size for stone pavement there is. The Boston size is too small, and allows of no bond between the separate paving stones. Further, the weakest part of each stone being its edge, it follows that the more edges there are in a given surface of pavement, the speedier will it wear out, each stone becoming rounded and slippery. It is only the excellent workmanship and great care displayed in setting these stones in Boston that prevents these facts from being at once apparent to all. When it is added that in setting pavements, the natural soil, except it be sand or fine gravel, is in all cases to be excavated 12–19 inches, and then filled up 5–12 inches, according to the solidity of the subsoil, with *clean*, coarse sand or fine, *clean* gravel, and the paving stone set in this and well rammed down with hand rammers, about as much is said on this topic as can be said without going into long details.

From four and one-half to six cubic feet of sand are required for every square yard of paving. In setting two different pavements, the same written rules may be exactly followed in either case, yet one be much better than the other, so much depends here upon good, careful, conscientious workmanship.

Wooden Pavements.—There are so many kinds of these, that it would be out of place to enumerate and describe them all here. Their advantages are, less wear on tires and horses, less noise and smooth traction; a disadvantage, is their slipperiness

in the winter. There seems to be a sort of notion that wood pavements and coal tar must go hand in hand; but there certainly is no necessity for this. Coal tar is applied as a preservative to the wood; but it must be acknowledged that many better ones are known and indeed are used, to the utter exclusion of coal tar, in all cases where it is desired to preserve wood, except in this of wood pavements. No wood should be used in paving that has not been first subjected to some approved method of preservation, or impregnation, as it is frequently called. The best manner of setting the same is still a mooted point, which it would be presumptuous at present to decide.

Cast-iron pavements are out of favor on account of their great cost, and concrete pavements are a matter of experiment as yet.

Asphalt pavements are chiefly used in Paris. They are slippery in wet weather, and produce a very disagreeable, penetrating dust in dry weather. It is necessary to prepare a bed of macadam to lay them on, and they are not used in Paris except in streets where the gas-pipes are carried either in the sewers or under the sidewalks, as any leak of gas would destroy them. Their use is a matter of doubtful economy.

Trackways are, as has been mentioned, out of date. Where a common road does not suffice now-a-days, a railroad is built; but time was when trackways were of considerable importance. They consist, if of stone, of large, flat stones, say 12″ deep and 4–6 feet long by 14″–16″ wide, solidly bedded in two parallel rows, at such distance apart as to make of each row a track for the wheels. The space between is paved. They are of course very expensive, but cost little to repair, and enable a horse to pull a very great load. As has been mentioned, Telford made use of such a stone trackway, to avoid cutting down a hill, on his Holyhead road. There were two hills, each a mile in length, with an inclination of 5 in a hundred. It would have cost $100,000 to reduce this grade to $4\frac{1}{6}$ in a hundred, but nearly the same advantage, in diminishing the tractive force required, was obtained by keeping the 5 in a hundred grade, with moderate cuttings and embankments, and making stone trackways, at a total expense of less than half the former amount.

"Plank roads," once so much in vogue in the United States, may not improperly be classed among roads with trackways,

and, with them, also among the things that were. From their perishable nature, they can never advantageously do more than help the development of a new country, and in this, as well as other States, are yearly becoming more and more impracticable on account of the constantly increasing price of lumber.

On the Resistance to Motion or the Force required to move Vehicles on different Kinds of Roads.

Before, as well as since the introduction of railways, engineers in England, Germany and France made many experiments on the force necessary to pull different vehicles, at various speeds over various surfaces. To enumerate the details of all these experiments would be perhaps useless ; a few general results only are here given.

Experiments, as above indicated, were made by Edgeworth, Count Rumford, Bevan, Macneill, Minard, Navier, Perdonnet, Poncelet, Flachat, Morin, Kossak, Umpfenbach, Gerstner, and no doubt others, a list of authorities that proves the subject to have been well nigh exhausted. The experiments of Morin, made in 1838–41, appear to have been made with a degree of care and accuracy, leaving nothing more to be desired, and the following table is an extract from his results,* and gives that fraction of the weight of the vehicle and load, which is required to move them on a level road :—

* A full account of Morin's experiments on the resistance to motion of vehicles, on the wear caused by different vehicles on roads and on the loads different vehicles should carry so as to produce the same wear, may be found in Morin, *Expèrience sur le tirage des Voitures, Paris*, 1842.

CHARACTER OF THE ROAD.	CHARACTER OF THE VEHICLE.					
	2-wheeled carts.	Trucks, 4-wh., three and four horse.	4 horse stage-coaches, on springs.		2-horse carriages, body on springs.	
Firm soil, covered with gravel 4″–6″ deep, ...	$\frac{1}{12}$	$\frac{1}{9}$	$\frac{1}{8}$		$\frac{1}{8}$	
Firm embankment, covered with gravel $1\frac{1}{4}$″–$1\frac{1}{2}$″ deep, ...	$\frac{1}{16}$	$\frac{1}{11}$	$\frac{1}{10}$		$\frac{1}{10}$	
Earth embankment, in very good condition, ...	$\frac{1}{41}$	$\frac{1}{29}$	$\frac{1}{26}$		$\frac{1}{26}$	
Bridge flooring of thick oak plank, .	$\frac{1}{70}$	$\frac{1}{46}$	$\frac{1}{41}$		$\frac{1}{42}$	
BROKEN STONE ROAD.			Walk.	Trot.	Walk.	Trot.
In very good condition, very dry, compact and even, ...	$\frac{1}{75}$	$\frac{1}{54}$	$\frac{1}{48}$	$\frac{1}{41}$	$\frac{1}{49}$	$\frac{1}{42}$
A little moist or a little dusty, . .	$\frac{1}{53}$	$\frac{1}{38}$	$\frac{1}{34}$	$\frac{1}{27}$	$\frac{1}{34}$	$\frac{1}{27}$
Firm, but with ruts and mud, . .	$\frac{1}{33}$	$\frac{1}{24}$	$\frac{1}{21}$	$\frac{1}{18}$	$\frac{1}{22}$	$\frac{1}{19}$
Very bad, ruts 4″–$4\frac{1}{2}$″ deep, thick mud,	$\frac{1}{19}$	$\frac{1}{14}$	$\frac{1}{12}$	$\frac{1}{10}$	$\frac{1}{12}$	$\frac{1}{10}$
Good pavement, Dry, ...	$\frac{1}{90}$	$\frac{1}{65}$	$\frac{1}{57}$	$\frac{1}{38}$	$\frac{1}{59}$	$\frac{1}{39}$
Good pavement, Covered with mud, .	$\frac{1}{69}$	$\frac{1}{50}$	$\frac{1}{44}$	$\frac{1}{33}$	$\frac{1}{45}$	$\frac{1}{34}$

To take an example, suppose we have a truck weighing with its load 9,000 lbs. How many pounds traction will be required to move the same?

Ans.—On firm soil, gravel 4″–6″ deep, that is, a newly repaired road, as we often find it, ($\frac{1}{9}$ by table,) 1,000 lbs.; on best kind of embankment, ($\frac{1}{29}$ by table,) 310.3 lbs.; on broken stone road in good condition, ($\frac{1}{54}$ by table,) 166.6 lbs.; on broken stone road, deep ruts and mud, ($\frac{1}{14}$ by table,) 643. lbs.; on a good pavement, ($\frac{1}{65}$ by table,) 138.5 lbs. Or, since the tractive force of a medium horse when working all day is said to be about 125 lbs., we need in the first case, 8 horses; in the second case, $2\frac{1}{2}$ horses; in the third case, about $1\frac{1}{4}$ horses; in the fourth case, about 5 horses; and in the fifth case, only one good horse to move the same entire load all day.

These facts expressed in the preceding page or two in striking, yet perhaps dry figures, can be nearly as well given in popular language.

Says a correspondent (Dr. Holland,) of the "Springfield Republican," writing from England, after describing the kind of horses in use there:—

"Now with all these horses the rule follows that every pound of muscle does just as much work on the road as two pounds do in America. The cab and omnibus horse does twice as much as the same horse does in America. The draft horse does as much at the dray as two ordinary dray horses in America, and the little horses, which are driven mainly in butchers' carts and grocers' carts, will tire a cab horse to follow them with no load at all.

"In connection with these statements it should be recorded that the speed of all vehicles in the streets of London, whether the localities be crowded or not, is at least a third faster than it is in corresponding streets in American cities. The ordinary speed of vehicles in London, in which passengers or light loads are transported, is one which is considered not entirely safe in Main Street, Springfield, Mass., and one which, in some streets of Boston or New York, would be at once checked by the police. A man who sits in a 'Hansom' finds himself driven at an unprecedented pace through crowded thoroughfares, and Yankee though he may be, he will often wonder whether he is going to bring up at last without a broken neck.

"I mention this matter of speed, particularly, because it shows that even more work is done by one horse in London, than by two in New York. He not only draws as large a load, but he travels with greater rapidity. The streets of London present such a spectacle of headlong activity as no American city can show, in consequence of the rapid passage of all sorts of vehicles through the streets. I might add to this statement, touching the superior speed of the London horses, a word about the greater weight of the carriages which they are obliged to draw behind them. All carriages are built more heavily in Great Britain than in America. They are built to last, and many of them seem to me to be superfluously heavy.

"The point which I wish to impress upon my American reader is simply this: that the English horse, employed in the streets

of a city, or on the roads of the country, does twice as much work as the American horse similarly employed in America. This is the patent, undeniable fact. No man can fail to see it who has his eyes about him. How does he do it? Why does he do it? These are most important questions to an American. Is the English horse better than the American? Not at all. Is he overworked? I have seen no evidence that he is. I have seen but one lame horse in London. The simple explanation is that the Englishman has invested in perfect and permanent roads what the American expends in perishable horses that require to be fed. We are using to-day, in the little town of Springfield, just twice as many horses as would be necessary to do its business if the roads all over the town were as good as Main Street is from Ferry to Central. We are supporting hundreds of horses to drag loads through holes that ought to be filled, over sand that should be hardened, through mud that ought not to be permitted to exist. We have the misery of bad roads, and are actually or practically called upon to pay a premium for them. It would be demonstrably cheaper to have good roads than poor ones. It is so here. A road well built is easily kept in repair. A mile of good macadamized road is more easily supported than a poor horse."

Other results of Morin's experiments are as follows:—

1. The force required to draw a vehicle, is directly proportional to the load and inversely so to the diameter of the wheels; in other more common words, the tractive force increases in the same ratio that the load increases, and the diameters of the wheels decrease.

2. On a paved or well built macadam road, the tractive force is independent of the width of the tires, provided the same is more than three or four inches. On compressible roads, such as new gravel, on a meadow, &c., the tractive force diminishes with an increase in the width of the tires.

3. Other circumstances being equal, the tractive force is the same for vehicles with and without springs as long as the horses are not moving faster than a walk.

4. On paved and well macadamized roads the tractive force increases with the velocity, according to the law, that beyond a velocity of $2\frac{1}{4}$ miles per hour (23.31 feet per second) the increase of the tractive force is in direct proportion to the in-

crease in velocity; this increment is however less, the softer the track or road and according as the vehicle is best provided with springs.

5. On soft earth embankments, or on sand or sods, or on streets newly covered with gravel, the tractive force is independent of the velocity.

6. On a well made pavement of regular shaped stone, the tractive force, horses on a walk, is about three-fourths of that on a good macadam road, but with horses on a trot, the two are about equal.

7. The wear on the road is greater the smaller the diameter of the wheels and greater in the case of vehicles without, than for those with springs. Most road-rollers, as now in use, have too small a diameter besides being too light and consequently do not properly compress the road surface.

8. The tractive force, as well as the wear on the road, is greater in the case of vehicles that have their wheels placed at an angle with the vertical by reason of the ends of the axle-trees being bent down, than for those that have their wheels set plumb and the centre line of the axle-trees level.

PART II.

ON THE "BEST METHODS OF SUPERINTENDING THE CONSTRUCTION AND REPAIR OF PUBLIC ROADS IN THIS COMMONWEALTH."

In looking for a solution of this question the people of the Commonwealth may turn as they choose, either to the West or to the East, to see a guiding star; to the city of Chicago, or to the city of London, both under a republican form of government, alike or similar to that we live under. It lies in the establishment of a Board of Public Works, composed of a number of able men, well paid for their services, gradually changing in their membership in the Board who shall have this and only this as their occupation and who can therefore be held responsible for their acts. This is the system that has been adopted both in London and in Chicago and with remarkable success and resultant benefits. There are many other systems in use in foreign countries all of which however seem to be inapplicable here, placed as we are, under so different forms of government; hence, though well acquainted with the systems adopted in France and in Germany, the writer has not described them here.

The history of "the Metropolitan Board of Public Works of the City of London" is about as follows:—

What is known as the city of London consists in reality of a great number of what we should call towns, there called parishes, and of which the "*city of London*" is only one single member. Each one of these parishes had, and still has in most respects, its own local government and in consequence, took care of its drainage, its streets, &c., &c., as seemed best and as it liked, some better, some worse and some not at all. This state of things in the matter of drains and sewers finally led to a most deplorable condition of affairs; there was not nor could there under these conditions be such a thing as a *system* of sewers and consequently a proper and adequate drainage; the death-rate increased to an alarming extent and matters came to be universally regarded as past all endurance. What could be the remedy? No well grounded complaint could be made against the majority of the men composing the various local govern-

ments, since they were good and honest citizens and hence no change in the separate governments could ever bring relief. The fault lay not in the men, but in the system of ruling they were called upon to fulfill, that is, in the incompetent and faulty treadmill of government they were annually called upon to keep in its usual operation. It was then seen that by having an elected power to supervise and regulate the sewage affairs of the whole metropolis, a complete *system* of drainage could be carried out, and thus only. Such a regulating power is exercised by the metropolitan Board of Public Works, chartered by Act of Parliament and composed of members elected from all parts of London. It is perhaps in place here to explain what is meant by a *system* of sewers as the same definition will hold good in other matters; as for a *system* of roads, of drainage and irrigation of lands, &c. Perhaps the best illustration would be to refer one to the veins and arteries in the human body, or to the body of a tree, from its trunk through the branches growing smaller and smaller down to the smallest twig that may be on it. It will be at once seen how different any arrangement, in which may be detected the wisdom to contrive, the strength to uphold and the beauty to adorn, like this, is from a miserable patchwork such as cannot but arise where the separate parts of one whole are each left to guide themselves without any unity of action or design, as to their final resultant. The London Board of Public Works had some extraordinary powers conferred upon it, such as the right to levy assessments on real estate benefited by their improvements, and others. Originally constituted merely to plan and execute a system of sewerage for the metropolis, this Board of Public Works soon showed itself so useful and beneficial in its actions that other matters were placed in its charge, such as the laying out of new streets, the building of the Thames embankment,—a work of exceeding great magnitude and importance,—and there seems to be no doubt that in all public works London will find it advantageous to employ its Metropolitan Board of Public Works.

In the city of Chicago there has been a Board of Public Works almost from the very start. It arose there from the union of the water supply and the sewerage commissioners, and has existed since May, 1861. No less than in London, it has proved to be of great benefit to the community; and it would

have been impossible, under any other system, to have executed in so satisfactory a manner the many and useful public works for which Chicago is famed. At the risk of introducing in this place some very dry reading, a general synopsis of those parts of the city charter which relate to the Chicago Board of Public Works is here given. The whole may be found in a copy of "Laws and Ordinances, Chicago, 1866."

SECT. 1. Establishes a body known as the *Chicago Board of Public Works*, to consist of (3) three members, chosen by the people, one from each division of city.

The first *three* chosen for one, two and three years; after that, one each year for three years.

SECT. 2. Each member of board shall receive annual salary of three thousand dollars (by Act of February, 1866); give bonds for faithful discharge of duties; pay over all moneys, papers, &c., at expiration of his term, or when ordered by city council.

SECT. 3. Board to elect president and treasurer, and make by-laws.

SECT. 4. Majority constitutes quorum; records to be kept of proceedings; copies of all plans, estimates, &c., to be kept; report (annual,) to be rendered on or before each year, or when required by city council. Each member authorized to administer legal oaths.

SECT. 5. Board shall have special *charge* and *superintendence*, subject to the laws and ordinances of city council, of all streets, lanes, alleys, &c., in the city of Chicago, and of all walks and crossings in the same, and of all bridges, docks, wharves, public places, landings, grounds and parks in said city, and of all halls, engine-houses and other public buildings in the city belonging to city, except school-houses, and of the *erection* of *all* public buildings; of lamps and lights in streets, &c., and in public buildings, and repairs of same; of the harbor works and improvements; of the city sewers and drains and of the water works; of the fire-alarm telegraph, and all public works and improvements hereafter to be commenced by the city, as well as such other duties as may be prescribed by the city council by ordinance.

SECT. 6. All applications or propositions for improvements,

or new works of kind specified in section five, shall hereafter be first made to Board of Public Works, or if made first to city council, shall be by them referred to board. Upon receiving application, board shall investigate the same, and if they find such work necessary and proper, shall thus report to city council, with an estimate of the expense thereof. If they do not approve of such application, they shall report the reasons for their disapproval, and the city council may then, in either case, reject said application or order the doing of work or making of public improvement, after having first obtained plans and estimates thereof. The board may also in like manner recommend, whenever they think proper, any improvement of the nature above specified, though no application has been made therefor.

SECT. 7. Shall be duty of board to procure for city full plans and estimates of contemplated improvements, when so ordered by council.

SECT. 8. Whenever any public improvement shall be ordered by city council, and money appropriated, board shall advertise for proposals for doing work; plans and specifications of same first placed on file in office of board, which plans and specifications shall be open to public inspection; advertisement to state work to be done, and to be published ten days at least. The bids shall *be sealed bids*, directed to board, and accompanied by bond to city, signed by bidder and two responsible sureties, in sum of two hundred dollars, conditioned he shall do work if awarded to him; in case of his default to do so, &c. Bids to be opened at time and place mentioned in advertisement.

SECT. 9. All contracts shall be awarded to lowest reliable bidder, and who sufficiently guarantees to do work under superintendence and to satisfaction of board: *provided*, that the contract price does not exceed the estimate, or such other sum as shall be satisfactory to board. Copies of contracts to be filed with city comptroller.

SECT. 10. Board reserves right, in contracts, to decide questions as to proper performance of work and meaning of contracts; in case of improper construction may suspend work and relet same, or order entire reconstruction; or may relet to other contractors and settle for work done, &c.

In cases where contractor properly does work, board may, in their discretion, as work progresses, grant to said contractor es-

timate of amount already earned, reserving fifteen per cent. therefrom, which shall entitle holder to receive amount, all other conditions being satisfied.

Sect. 11. In case prosecution of any public work be suspended, or bid be deemed excessive, or bidders be not responsible, board may, with written approval of treasurer, where urgency of case and interests of city require it, employ workmen to perform or complete any improvement ordered by council: *provided*, that the cost and expense shall in no case exceed the amount appropriated for the same.

Sect. 12. All supplies of materials, &c., when costing over five hundred dollars, to be purchased by contract, subject to same conditions as letting out work.

Sect. 13. Whenever board think necessary for interests of city, to protect same from damage or loss, shall report thus to aldermen, and reasons for same, asking power to give contracts without notice required above, and aldermen may grant request: *provided*, three-fourths vote for it.

Sect. 14. Whenever board is of opinion work may be better done without contract, shall so report to council, and same may authorize board to procure machinery, materials, &c., hire workmen, &c.: *provided*, a three-fourths vote be in favor of granting authority.

Sect. 15. All contracts and bonds by board to be in name of city.

Sect. 16. No member to be interested in any contract; all contracts made with any member interested, city may declare void; any member so interested shall forfeit his office and be removed therefrom; the duty of every member of board and of every officer of city to report delinquency, if discovered.

Sect. 17. All existing contracts executed by city, by water or sewarage department, &c., to be carried out by board.

Sect. 18. Board shall nominate each year the various officers, now provided for by ordinance, which serve in the departments under their special charge, the city engineer, superintendent sewers, streets, &c. Shall be empowered to employ from time to time such other superintendents, clerks, &c., as they may deem necessary, subject to ordinance as regards pay, &c.

Sect. 19. Board to have charge and superintendence of works made for city, and paid for by private individuals or by State. Plans for same to be approved by board.

SECT. 20. Board shall, on or before every year, submit to auditor, by him to be presented to council with annual estimate, statement of the repairs and improvements necessary to be undertaken for current year, and of the sums required by board therefor ; report to be in detail ; report, having been revised by council, sums required shall be provided for in annual tax-levy. All moneys to be paid to any person out of moneys so raised, shall be certified by president of board to auditor, who shall draw warrant on treasurer therefor, stating to whom payable and to what fund chargeable ; such warrant to be countersigned by president of board.

SECT. 21. Board to keep accounts, showing moneys received and spent, clearly and distinctly, and for what purpose. Accounts to be always open for inspection of auditor or any committee appointed by city council.

The object of introducing this synopsis here has been to give a complete picture of just what such a Board of Public Works is. It will be seen upon a little examination how entirely different a thing it is from the usual and only too customary "committee." Perhaps the greatest fault of a committee is its entire lack of what might be called body *and* soul. If corporations, as has been said, have no souls, a committee may be said to have neither body nor soul. It is alive to-day, wields great power, decides vital and important questions, and yet is nowhere to-morrow, and seemingly even its component atoms have vanished from the face of the earth. It is amusing and yet sad, when the action of some such committee has caused trouble to read some time after, that it all "is exceedingly discreditable to whoever is responsible for it." How much better to have a conservative, expert and reliable body, the members of which have *no other business* than to attend to their duties as such, who are well paid for it and consequently can at any time be held strictly responsible for their actions. With such a power, wisely governing and regulating the roads of this Commonwealth, it would be an easy matter to make thorough improvements in the legislation concerning roads and in the roads themselves.

These are two changes the need of which is generally felt at present and has found expression in various ways.

It may be well to quote one at least, notable for saying very

much in little compass,—of these calls for improvement, in this connection, and adding some more as belonging to this subject in the form of an interesting appendix. Says Gov. Claflin in his Inaugural: "Few things are of greater importance to a community, or a surer test of civilization, than good roads. Those of our citizens who have visited Europe are unanimous in the opinion that our public roads are far inferior to those of other countries, where the means of easy and safe communication are better appreciated. The science of road-making is apparently not well understood; or, if it is, the present modes of superintending the construction and repair of roads are so defective that the public suffers to an extent of which few of us are aware. It may be found upon investigating the cause of our miserably poor and ill-constructed roads, that the laws relating to this subject need revision, so as to give more uniformity in their construction and the repair of our highways. It is evident, also, that the science of road-making should have a prominent place in the course of applied mathematics at the Massachusetts Agricultural College."

We stand then in this matter of roads at precisely the same point that the good people of London did ten or a dozen years ago in the matter of their drainage, and our remedy is the same. The fault lies in the machinery of government; originally built up to cater to the wants and needs of a newly settled country,—a colony breaking a path through the wilderness,—it has long since ceased to satisfy the demands of the present *State* in no matter so essentially as in that of its government and laws relating to common roads and highways. This is a subject requiring special knowledge, to be acquired only by long experience or the shorter method of imbibing the experience of others, which on analyzing it, is all that any *study* amounts to; formerly it was not so, and most any one sufficed to make improvements on Indian paths. We need then an *expert* government on this point.

There should be a distinction made between first, second and third class, or between, as they might be called, State, County and Town roads; the first two should not be left to be dealt with as it is the pleasure of each town. A chain cannot be perfect unless every link in it is so; no more can a road. The State must attend to the State and County roads and set a proper ex-

ample at least to be followed by the towns in the case of their roads. We need then a higher power than that of the towns.

It has been previously shown how we need a power that can be held responsible and is somewhat permanent, and to put it all together, we need, to order and maintain our highways, a Massachusetts Board of Public Works. For some years it would have its hands full in improving the existing main roads and laying out some new ones, but in course of time, as in the older countries of Europe, its principal business would be the *maintenance* of the roads. It must be remembered that the Board of Public Works is merely the intelligent servant and adviser of the legislative and executive; whatever sums the legislature appropriates for certain objects, that is taken by the board and made to yield its most in the shape of work accomplished. Beyond this and keeping its accounts, it has nothing to do with money or taxation.

The small state of Baden, a part of Germany, has been heretofore mentioned as a model in road construction and the care of the same. From a brief history of the roads of that country and their present management, we may take some useful notes. The account is that of the Chief Engineer of the department of "Roads and Hydraulic Engineering," which has this matter in charge and is therefore reliable.

"In Baden the condition of the roads has been a subject of great care. Within the last forty-five years many millions have been spent upon them and experience has shown this expenditure to be one of those most advantageously spent. As most of the roads are well laid out and as there are plenty of them, there remains now (1863) mainly the keeping in repair of the roads to be attended to and not to build any new ones. Our endeavor now is, to do this at the minimum of cost. Statistics gathered on this subject, show good results and point out to us the means of arriving at still better ones. The present road law was made in 1810. That part of the old law which relates to the maintenance of roads is still in force, but that part requiring labor as a road-tax was abolished in 1831, and likewise most of the road police regulations. The appropriation for roads had to be increased 250,000 florins to pay for the abolished road-tax labor and to make up 170,000 florins previously received from tolls, which were also abolished in 1831. The system now is as

follows: All town roads are taken care of by the towns. The State merely appoints and pays a road-master, so called, who superintends fifteen or twenty road-keepers and reports on the state of the roads, the reasons for their bad condition, if that be the case, what is needed, &c. The law for second class or county roads was formerly, that when they were of importance to several towns, they had all to help maintain the same. As this gave rise to continual bickering and quarrelling, in which the road suffered most, it was changed in 1856. They are now taken care of under the direction of the State and paid for partly by the State and partly by the towns in which they are situated. Most of the roads under this head are those which have risen in importance since the building of railroads, and are generally those that lie perpendicular to the direction of the railroad they are influenced by. The towns not having the means very often to properly improve and repair such, it was found necessary and expedient to give them the aid of the State, and in order to procure the necessary funds, all roads that run parallel to railroads and all those that had lost their importance by the construction of railroads, were in 1855 stricken from the list of state roads. These latter as the name implies, are wholly under the care and kept up at the expense of the State.

In 1835, the total length of the State roads was .	1,430.8	English	miles.
In 1855, " " " " was .	1,500.8	"	"
In 1855, by excluding several State roads, this last length was reduced to	1,142.4	"	"
In 1861, it had increased to	1,190.0	"	"

Second class roads, (keeping partly paid for by State.)

In 1835, the length of these was	467.6	English	miles.
In 1861, the length of these was	630.0	"	"

" So that the State had, in 1861, in all, 1,820 English miles of road to maintain, the towns helping to pay on six hundred and thirty miles thereof.*

* According to Chambers Encyclopædia, Baden has an area of about 5,900 square miles, and had a population, in 1858, of 1,335,952. It is probably this, or a little less, at the present time. Massachusetts has an area of about 7,800 square miles, and, according to the average of the computed populations in the supplementary tables of the census of 1865, it is, in 1870, 1,343,604.

Or, population per square mile in Baden, ... =226.43
" " " in Massachusetts, . . =172.26

By the same tables, accompanying the State census of 1865, we find that

"The statistics of the road repairs are kept in the following manner. The road-keepers are required to keep a record of all draught animals that pass in either direction. Horses that are being ridden, animals not before a vehicle, and teams going to and from the fields, are not counted. These records are kept only during the working hours. Likewise, not during the whole year, but only four months in each year, so selected as to give an average amount of travel. The travel on the road on Sundays and out of working hours is taken from a few observations; it is a very small percentage of the whole. At the end of the year these records and observations are collected and graphically represented on a map of the whole State. The different roads are drawn of a different thickness of line, according as the amount of travel on them is greater or less. The quantity of road metal used per yard of road, and the kind of metal used, give the data for another such map, in which the different colors of the roads represent the different materials used in their repair, and the figures on them and their thickness show the number of cubic yards per mile required to keep the road in order. Finally, we have a third map, which indicates, by the thickness of the several lines representing the roads and by the figures on them, the total cost per mile of repairing the road one year."

With this picture of a country happy and prosperous, in the possession of good and well-kept roads, it may be well to leave the subject.

Massachusetts wants, for her proper development, much better roads than she now has; and, reckoning for a period of say fifty years, she can have these good roads, and have them kept in order, at a less cost than that of keeping up the present poor ones for the same time. Besides this, we should see in the one case a healthy state of internal communications and trade; in the other an absence of both. Let each citizen so act and do his part, that these benefits may accrue to the Commonwealth.

the population per square mile of Massachusetts will equal that of Baden, above given, somewhere between 1890 and 1891. It exceeds that of Prussia, and probably equals that of France at the present day, both of which countries have systems of roads and road-repairing but little, if any, inferior to those of Baden.

APPENDIX.

CONTAINING SOME RECENT EXPRESSIONS OF PUBLIC OPINION ON THE SUBJECT OF BETTER ROADS AND ROAD MANAGEMENT.

[From the "Boston Daily Advertiser," April 25, 1869.]

Probably the heaviest tax paid by the people of Massachusetts, is that which they pay, in one form and another, for the privilege of maintaining some of the worst roads in existence. At this season, one may see anywhere in the country the full process of paying this tax. Indeed, within ten miles of this city, where we are in the habit of thinking that the arts of civilization are tolerably well understood, the traveller will find great county roads, like that leading through Somerville to Medford, for example, over which there is constant and important transportation, which are in such disgraceful condition that they might reasonably be the subject of indictment. Whoever complains will be informed that the trouble comes from the frost and from the season; but whoever takes pains to learn how far we of New England are behind other parts of the world—saving and excepting the rest of our own country—in the art of road making, knows that the real trouble is that we neither build our roads in the first place nor keep them in order afterwards; and that we thus continue to pay, directly and indirectly, a tax which, if we could have it assessed in the regular way, would cause a political revolution among us.

Undoubtedly we should be obliged to make a considerable original outlay, in order to secure the drainage of our roads and their construction of proper material. By drainage, we mean, of course, not the "crowning" of the road and the digging of a ditch for surface water, but the laying of proper drains under the road itself, so as to keep the ground free from the moisture with which the frost works its mischief; and by proper material we do not mean the solid filling of gravel or even loam with which matters are now annually made worse, but the broken stone, of various degrees of coarseness, with which a road-bed is made permeable by water below, and smooth on the surface. Certainly all this costs at the outset. But the road built as the road makers of the old world,—

and we are glad to say of one or two towns in this vicinity,—build them, scarcely shows the effect of "the frost coming out of the ground" in the spring, or of the early freezing in the fall; and in subsequent expense it is by far the cheapest. The traditional highway surveyor expects to find his roads badly cut up by the spring travel, and repairs the damage at a heavy cost to his neighbors; the regular road maker provides a highway which is never cut up while ordinary care is taken of it.

The experience of the one or two towns to which we have referred,—of which Waltham is the best example,—has shown that in the matter of annual expenditure, as a mere method of economy to the town treasury, it is cheaper to have roads well built, and then to keep them in high condition, than to undertake the annual repairs which are so familiar throughout New England. That is, it is cheaper to have a few men to watch for the beginnings of any wear upon the roads, and to mend a defect when it first appears, than it is to wait until the trouble becomes serious, and then set a large force at work. One man, with a shovelful of broken stone, can prevent what it may require half a dozen, with a team, to cure after a few months' neglect.

But the heaviest part of our highway tax is no doubt that which is levied upon us by the destruction of horseflesh, the impeding of public travel, the wear of vehicles, and the increased cost of transportation over our poor roads. This is a tax which, without any assessor or collector, is inexorably exacted from every barrel of flour, every bag of grain, every box of goods, and every person, passing over our travelled roads. As it is levied indirectly, and more than all, as we have always paid it, nobody thinks of it. But it is one of the heaviest burdens resting on the people of Massachusetts and of New England, borne by those who rank among the most thrifty and progressive people on earth, and who, nevertheless, in this every-day matter, are demonstrably rather more than two thousand years behind the world.

EXTRACTS

From a Report of the Committee on the Appointment of Road Engineer, to the Town Meeting in Newton, held May 3, 1869.

Your Committee consider that the question of the employment of a road engineer largely involves the question whether the roads of the town of Newton shall continue to be repaired in the old-fash-

ioned, temporizing manner, or whether the work shall be done thoroughly. And they are satisfied that the true interests of the town will be best promoted by employing the best attainable engineering skill; by having the roads over which heavy teams travel macadamized with broken stone, and also by having the gravelled roads, as well as the broken stone roads, underdrained in all places where springs manifest themselves, or where higher land adjacent to the road makes it wet and muddy. The test of a road is its condition in bad weather and its power of sustaining heavy teams without being cut up in ruts or pounded full of holes; and certainly some of the roads in Newton, although in fair condition in dry weather are not able to resist rains nor sustain heavy teams. Should the town purchase a stone-crusher, and decide to repair with broken stone, it will still be no less necessary to underdrain, or, in some suitable way, relieve the road-bed of water, or the macadamizing will not be effectual. A good engineer has the gathered and recorded experience of communities and nations. He knows, or should know, the relative qualities and degree of adaptation of different kinds of rock for the purpose of macadamizing; he can detect anything in the subsoil which renders it unfit for a road-bed, and suggest a remedy. He can calculate the area of rainfall in a given precinct and determine the amount of drainage, and the necessary size of culverts and bridges. He can grade drains, both surface and concealed, at the proper angle, and select the most feasible route for their construction. He would know about different crushing machines, their prices and relative value. His knowledge and suggestions would save the town many times his salary by enabling the town to avoid useless and perhaps costly expense. And it may be hoped that in a couple of years our present superintendent, or some other person, would have thus received such hints and information as would enable him to manage our roads without the supervision of an engineer.

The town of Waltham macadamizes its principal streets. It keeps ten to fifteen men under constant employ, and much of the time on the roads; one of these men has thus been engaged for twenty years. Their superintendent of roads has held his situation twelve years; his salary as road master is $800; he is also paid $100 as highway surveyor. Waltham, in 1865, had fifty-one miles of road, and for the previous seven years its roads had cost the town an average of $3,357 a year, or about $66 a mile. It cost that town the past year for repairs of roads and clearing off snow $6,000 for sixty miles of road. The town of Newton expended for repairs and clearing of snow in the same time on eighty-two miles the sum of $14,523

or $176 a mile. It will thus be seen that our system of partial or incomplete repair is almost twice as expensive.

But this is taking the most narrow view of the subject. An editorial in a recent Boston paper says: "The heaviest part of our highway tax is no doubt that which is levied upon us by the destruction of horseflesh, the impeding of public travel, the wear of vehicles, and the increased cost of transportation over our poor roads. This is a tax which without any assessor or collector is inexorably exacted from every barrel of flour, every bag of grain, every box of goods, and every person, passing over travelled roads. As it is levied indirectly, and more than all as we have always paid it, nobody thinks of it. But it is one of the heaviest burdens resting on the people of Massachusetts and of New England, borne by those who rank among the most thrifty and progressive people on earth, and who nevertheless in this every-day matter are demonstrably rather more than two thousand years behind the world." That this is not imaginary, statistics show. General Morin found, by careful experiment, that "carriages on springs, drawn upon a new road covered with gravel five inches thick, required in tractive force *one-eighth* the load; upon a solid causeway of earth, with gravel one and a half inch thick, one-tenth the load; upon a causeway of earth in very good condition, one-twenty-sixth the load; upon a broken stone road, very smooth, one-forty-fifth the load; upon a broken stone road, moist or dusty, one-thirtieth the load; upon a broken stone road, with ruts and mud, one-twentieth the load; upon a broken stone road, with deep ruts and thick mud, the tractive force required was one-tenth the load." It will thus be seen that the smooth causeway of earth, in very good condition, required but one-twenty-sixth of its weight in tractive force to draw it, while the smooth broken stone road required only one-forty-fifth the weight of the load in tractive force.

Before the invention of railroads the attention of engineers in Great Britain and on the continent of Europe was largely given to the construction of common roads and turnpikes, upon which the heavy travel of those nations depended. Telford built, more than fifty years ago, 800 miles of road in the highlands of Scotland, still admirable and in constant use. The roads built by the French engineers of the first empire are still among the finest in the world. No one that has travelled over the Simplon road, or the Mt. Cenis road, or from the St. Bernard pass to Martigny, or all around the Bay of Naples to Sorrento, on a road built by Murat and which the lazy Italians have had the grace to let alone, can possibly resist the claims of a good, smooth, hard road. It adds new charms to scenery and

imparts a fresh zest of life. But to come back again to statistics. MacNeill constructed a machine to test the amount of tractive power required on different roads. This was carefully tested by many very eminent engineers. Their experiments showed, uniformly, that the force of traction is, in every case, nearly in exact proportion to the strength and hardness of a road. They found that on a road made with a thick coating of gravel, a load, which required the power of one hundred and forty-seven pounds to draw it, could be drawn on a broken stone road with a power of sixty-five pounds; and on a road of broken stone of great hardness, laid on a foundation of large stones set in the form of a pavement, the power required to remove the same load was but forty-six pounds; and this last road effectually resisted frosts.

On the 6th inst., your Committee visited Waltham, and found the broken stone road there dry and hard. It will sustain loads of six tons without being cut into ruts. Returning, we came down through Waltham street, and, observing the instant of passing from town to town in the changed character of the road, we passed on to Newtonville over our fine old avenue! The first road required scarce any mending. The last was cut up with ruts and full of mud, and workmen were dumping gravel four to six inches deep upon it. On the Waltham road it required not more than one-fortieth the weight of the load (say 20 lbs.,) in tractive force to draw it, while on the main road of the good, rich old town of Newton, it would have required one-eighth the weight of the load (100 lbs.,) in tractive force to draw it. That this criticism is not especially in the interest of persons driving in light carriages and for pleasure, may be seen from the fact,—as demonstrated by careful and extended experiment,—that resistance to the onward motion of the carriage or cart, arising from roughness of the road, is always in proportion to the weight of the carriage. A double weight will offer double resistance, and a triple weight triple resistance, and so on. In truth the principal objection of some, who have had little or no experience with the broken stone road, is, that it is unfit to drive horses rapidly upon; such a road improperly made, or imperfectly hardened, is indeed unsuitable for rapid driving; but it requires only a journey of three hundred miles* to see millionaires driving the finest trotters in the world, upon roads as smooth as a floor, made entirely of stone.

Can any measure be more likely to increase the popularity of our town, or add to its population, than to construct roads as solid, smooth and perfect as the nature of the case will admit?

* To the Central Park, New York.

[Correspondence of "Advertiser."]

It is recorded of the Rev. Mather Byles, that he saw one day a chaise, containing the town clerk and a selectman of Boston, stuck, before his house in School Street, in a quagmire which he had long tried to induce the town to mend. He pulled off his hat and cried to them that he was heartily glad at last to see the authorities "stirring in the matter." The writer is as glad as the reverend doctor was, to see so good an authority as the "Advertiser" stirring in the matter of our *roads*, though by no means in so muddy a style as the worthies referred to. A month or more ago you published extracts from the report of the committee appointed by the town of Newton, recommending the employment of "a road engineer, to have supervision of the roads in connection with the selectmen, and to survey the town with reference to laying out new streets." This report was adopted by the town. A number of your readers in our beautiful suburban towns wish that you could find space to publish the whole report, or that the selectmen of Newton would circulate it as a tract throughout the environs of Boston, where our excellent authorities are contented to believe that roads, which are well nigh impassable during seven months of the year, are good roads, because they are in fair order through the summer months.

It would seem that in such rich towns as those which surround Boston, the public had a right to demand as durable, solid and smooth highways as lead into any city in the world. But we are told that they have worse roads in Little Pedlington, or the frosts in New England are so severe, or there are horse railway tracks in our streets, or we have such heavy travel over *our* roads, that we ought to be proud of the roads instead of grumbling at them. So the "seelic-men" continue to dump big rocks and loam, turf and brickbats into the streets; and if the town owns a "stone-cracker," the sharp fragments are strewn along the ways, to be beaten down by hoof and wheel, as if a layer of gravel and a roller existed only in the heated dreams of condemned highwaymen. Next, the autumn rains, the winter frosts and the spring winds do their work, and the expressmen, and the farmers, and the doctors, and the teamsters, and the milkmen, try to do theirs, over the torrent-beds and springholes we fondly call our "streets," ruining their wagons, killing their horses, and endangering their souls by consequent profanity.

It is not those who drive for pleasure who are concerned in this matter; it is the crowd of hard-working men we have just named. Such men, if they could read the report referred to, would see that

"the heaviest part of our highway tax is no doubt that which is levied upon us by the destruction of horseflesh, the impeding of public travel, the wear of vehicles, and the increased cost of transportation over our poor roads." That, while over a bad road "there is required in tractive force *one-eighth* the load," over a properly made one is "required only one forty-fifth the weight of the load in tractive force." "If we encourage with good roads, we shall speedily derive therefrom a great and permanent advantage." "Can any measure be more likely to increase the popularity of our town, or add to its population, than to construct roads as solid, smooth and perfect as the nature of the case will admit?"

But space will not allow us to quote the demonstrations of the report. The public will have durable and smooth roads when it has been pointed out that roads which are cut up and undermined for more than half the year are *bad* roads; that what is spent in making good roads, under the superintendence of an accomplished civil engineer, is saved ten times over in horseflesh and carriages; and that by proper building of roadways, by under-draining and macadamizing and rolling, we can have roads worthy of the name even in frosty New England. The irrepressible Yankee builds the best carriages, and breeds superior horses: what a pity it is he cannot make roads for them to travel on that will not wrench the former apart before the gloss is off the panels, or lame the latter by springholes, ruts and stones. The fact stands, however, that Americans are behind all civilized nations in the art of road making. Will you continue to call the attention of your readers to this melancholy but true statement, in order that you may share the proud eminence occupied by the great Highland road maker, of whom it is sung:—

> "Had you seen these roads before they were made,
> You would hold up your hands and bless Marshall Wade?"

SUBURBANUS.

SECOND PRIZE ESSAY

ON THE

CONSTRUCTION AND REPAIR OF ROADS.

By Samuel F. Miller, C. E.,

PROF. OF MATHEMATICS AND FARM ENGINEERING, MASS. AGR. COLLEGE.

A "treatise on the science of road making, and the best methods of superintending the construction and repair of public roads in this Commonwealth," being called for by a Resolve of the last legislature, I submit these few suggestions, not as exhaustive of the subject,—for my time will not allow me to attempt such an essay as seems to have been anticipated by the Act of the legislature,—but as the results chiefly of my own observation and experience.

The first roads of a country usually follow the high lands and ridges, when the intervening valleys are narrow, or the land is wet or heavily timbered,—and military roads are not an exception,—for the obvious reasons of greater security, less water to contend with, and being more easily built. Besides, roads built by citizens are at first only improved foot or bridle-paths leading from house to house; and the earlier settlers live upon the hills for good sanitary reasons. Hence, the problem of changing the location of the old highways is sure to come.

An Indian trail is a better route to follow for a road than a white man's path, for those great travellers, the Indians, learn intuitively to economize their strength. But our farmers are slow to learn that it would pay them back fourfold to make better roads, for many of them might thus be cut off from the travelled way, and they are not in the habit of figuring closely on the value of time, the cost of "wear and tear," animal

strength and feed. They would not be greatly moved by the statement that their roads to "town" might be made, within a reasonable cost, so that they could haul three times as much as they now do at each load, and make the trip in one-half the time. They are very conservative, and greatly averse to having their fields cut up again, especially in any other way than "square across."

And it must be admitted that it is a serious matter to take the travel from the doors of citizens, even though the public are obliged to provide an outlet, or to change the road so as to seriously impair the frontage of their buildings. And, on the score of public expense, we would not advise this, except it should be justified by the wants of travel.

But whether old roads are to be altered or new ones to be laid, the principles of location and construction are substantially the same. We will consider the whole subject under the heads of *Location*, *Grades*, *Road-Bed*, *Drainage*, *Bridges and Culverts*, *Repairs*, and *Superintendence*.

The science and art of road making have been carried to great perfection in England and France, and we have many books and statistics on the subject from these sources, as those of Tredgold, Wood, Parnell, Morin, McAdam, Telford, Rankine, and a host of others; while in this country, such manuals as those of Gillespie and Mahan, giving a digest of foreign experience adapted to American wants, are eminently simple, practical and suggestive; so that there seems to be nothing lacking except to notice the more important points as bearing upon the necessities of our own State. It is believed that skilful men to do the work will make up all the deficiencies of the books, and without them the books will be of little use.

Location.

When a road is to be located, there are termini that are fixed, and generally one or more points between. As a matter of economy, there should be no deviation from a straight line between fixed points without sufficient reason. But it should be borne in mind that road distance is measured on the surface, and not horizontally, as in land surveying; and the old illustration is to the point, that "a kettle bail is no longer when lying upon the rim than when erect."

Where a line *pretends* to be straight let it be *perfectly* so, and let the centre line of the road-bed, and side ditches, show this when completed. Then in place of angles there should be curves of definite radii, properly fitting the ground; for these shorten the distance, and are far more graceful, and more pleasant to drive over. The principal exceptions to this rule would be at cross roads, and perhaps in villages. While the tangents may be described by needle bearings and distances, the curves should be designated as to the right, or left, with such a radius, and such a distance. Stones, three feet deep, should be set at the tangent points, or in the fence lines opposite, and then the line is permanently fixed, and may be tested upon the ground at any time by the aid of a description as above.

Where the stones are set and preserved the record of the bearings of the needle is of little use, but otherwise it is of great value, provided you know whether the true or the magnetic meridian was meant, and, if the latter, what the variation was at that date. The difficulty in the matter is,—and our ordinary land surveying suffers still more,—most of our own surveyors do not know what the local variation is, or how to obtain it accurately; and in fact it is a problem of considerable difficulty with ordinary means.

Hence arises the great uncertainty in retracing many old surveys where the corners are gone, and troublesome lawsuits have arisen; for the needle in this State has never, so far as known, pointed within five degrees of north; and it is constantly changing at irregular rates, varying from one to six months each year: and the extreme difference of variation at the same time in different parts of the State is about three degrees. So that the record of one place may not answer for another ten miles distant.

In view of these facts it may not seem out of place here to state a very simple remedy. Let each town, or district of several towns, be provided with a true meridian in its central part, marked by three stones set securely in the ground two or three hundred feet apart, and let a yearly record be kept of the magnetic variation at each place. Then let every surveyor be required to test his instrument yearly, and every survey that goes upon record have appended a properly sworn certificate, stating whether the bearings are true or magnetic, and what the

surveyor calls the variation at that date. The expense of fixing these points, with sufficient accuracy for all surveying purposes, would be trifling compared with the immense advantage gained.

Physical reasons chiefly, such as cost of construction and maintenance, and proper grades, should cause deviation from a straight line, but there are, in extreme cases, considerations of "land damage" that may have weight; but a most careful balancing of first cost, with permanent detriment to the line, should be made.

In locating a road, the travel it is designed to accommodate, the character of the ground to be passed over, and the money that can be raised, are supposed to have been carefully considered in order to fix very nearly the maximum grade that can be allowed; and then the line must be made as direct as the nature and surface of the ground, and the passage of streams, will permit; always taking into account subsequent cost of repairs, as well as first cost.

In order to do this properly levels must be taken throughout the line, and a profile made, to show to the eye on paper the grades that can be obtained, with the "cuts" and "fills" at every point; and this, as finally established, should form a part of the record. Then, in construction, let the cuttings and fillings be plainly marked upon stakes set once in fifty or a hundred feet to guide the workmen. This grading by the eye is expensive in the end, for materials are apt to be taken from, and carried, to the wrong places.

It is a mistake, as often stated, that the cuts and fills should balance each other; on the contrary the latter should be usually large in excess, because casting, scraping, and wheelbarrow work, are so much cheaper than hauling, the road-bed is made so much dryer by elevation, and proper drainage easier to obtain.

It is best to adopt such a route as *ought* to be built, on a line of importance, even if at first unable to carry out fully the plan, for, with a definite recorded plan to work to, the completion may occupy several years, while, in the meantime, a good passable road can be maintained. This is the American plan of building railways, which has won for itself so high English commendation that the East India Company has been considering the question of employing our engineers to build railways in India.

The width taken for "right of way" should be designated at

every point on the plans of record. These should never be less than fifty feet, and greater widths must be taken at some points of heavy cutting or embankment; and, in general, there should be width enough for all purposes of drainage, and preservation of the road-bed, and for obtaining materials for construction and repairs; except for ballasting, which must often be obtained from gravel beds outside. It is better to have too much than too little.

Grades.

There are two general classes of carriages to pass over roads, one for freight, and one for passengers. The former wish to carry the heaviest loads, and the latter to make the best time. Undoubtedly where heavy loads preponderate, there is greater need of light grades, but in general, the road that is best for the one, is the best for the other class of travel.

We will designate grades in the usual way by a fraction having unity for the numerator, and the distance required to rise one foot for the denominator; for the simple reason that this fraction expresses the exact ratio of the draught to the load, as it would be were there no friction. For instance, a grade of one foot in one hundred is called $\frac{1}{100}$, three feet in one hundred $\frac{1}{33}$, and five feet in one hundred $\frac{1}{20}$, etc.

It seems to be well established that undulating grades of $\frac{1}{100}$ are no detriment, but, on the contrary, are rather beneficial, as giving better longitudinal drainage.

It is evident, too, that the grade should never exceed the "angle of repose," if possible; that is, the horse should not be obliged to hold back his load in descent, but the friction should be sufficient to counteract the force of gravity. This "angle of repose," or limit of grade, for different road-beds will vary from $\frac{1}{50}$ to $\frac{1}{10}$ on ordinary roads. It is easily ascertained from the draught upon a level with the same character of surface, for this is just equal to the friction, which would be the same upon an incline. For instance, if the draught upon a level, or what is required to overcome friction, is $\frac{1}{20}$ of load, then this fraction would exactly express the maximum grade to be allowed for same kind of surface, since, as stated above, the same fraction gives the ratio of draught to load to overcome gravity alone. So the "angle of repose" is the grade expressed by the

fraction which indicates the ratio of draught to load upon the same road-bed on a level.

Very many experiments have been made in Europe to find this ratio upon every variety of surface, and we have full tables of the results. We will only state briefly that upon such roads as we shall have in Massachusetts, varying from those of earth and gravel mixed, to those of broken stone, in good order, according to these data, the draught would range from $\frac{1}{10}$ to $\frac{1}{50}$ of load on a level. Now, *theoretically*, to find the power required upon any given grade, we have only to add to this the ratio of perpendicular rise to length of surface, i. e., the fraction expressing the grade. For instance, if the power on a level, with the same road-bed, is $\frac{1}{30}$ of load, on a grade of $\frac{1}{20}$ the power required would be $\frac{1}{30}+\frac{1}{20}=\frac{1}{12}$ of load. But, *practically*, this calculation for power required on grades from that on a level would lead to wrong conclusions, for a horse does not pull at so great advantage on an incline, on account of the position of his body, not being able like a man, to throw the centre of gravity forward at his will, and not having so good foothold, and the load, too, being thrown more upon the hind wheels, there would be increase of friction on a yielding surface. So we must resort to experiment again, as upon a level; and the general results are, that a horse can haul about $\frac{4}{5}$ as much on a grade of $\frac{1}{50}$ as on a level; $\frac{2}{3}$ as much on a grade of $\frac{1}{33}$; $\frac{2}{5}$ on a grade of $\frac{1}{20}$; and only $\frac{1}{4}$ as much on a grade of $\frac{1}{10}$ as on a level.

These are condensed general statements from English and French experiments; but the State should at once institute full experiments upon her own roads, with the vehicles in common use, and with such as shall prove the best.

Now the maximum grade upon any line being fixed from such considerations as have been named, it still remains a question of great importance how much you will increase the distance, or the cost, to reduce grades that are within the prescribed limits. No special rules for each case can be laid down, but they are questions for the engineer on the ground, in view of all the facts and principles that should control the decision. We will mention a few *general* rules that are well established.

1. The capacity of a line of road should not be limited by a portion which is a small percentage of the whole. If possible, let the greatest load that can be drawn up the steepest part be a

fair one for the balance. It would be justifiable to make considerable extra expense to reduce two or three hard points; certainly, if in no other way, by making the road-bed there so much better than the rest as to compensate for the extra steepness.

2. Where the difference in levels between two points on your line is large in proportion to the distance, avoid, if you can, any *counter* grades, as so much loss in your ascent. Within certain limits, *level* portions interspersed with varying ascents, always supposing that the line fits the ground, are no damage, but they serve to refresh the horse in a small degree.

3. Do not go *over* a hill if you can help it. It is usually no further around it, and if it is, the greater distance and cost may be amply compensated by the saving in time, wear and tear, and animal strength. Gillespie says it would be better to lengthen a road twenty times the perpendicular rise saved than to go over the hill; which is to be understood as a popular, rather than a scientific statement. When you *must* go over, the principles of the second rule would apply to reach the summit on either side.

4. It will not pay to make much more distance, or cost, to reduce grades not exceeding $\frac{1}{33}$ that are not very long. This is a general statement, to which there might be exceptions on some very heavy freight roads. On lines of such a maximum driving carriages will not usually change their average speed for level except to go a little faster down, and a little slower up, the steepest parts. But grades of $\frac{1}{25}$ and upwards may fairly be considered as worth reducing, according to their respective detriments. Gillespie, under the head of "Profits of Improvements," illustrates a good method of figuring such a problem.

It is suggested that our public roads might properly be divided into two classes, according to facts of traffic existing, or what may be expected from the greater facilities proposed; and the highest grade to be allowed in the first $\frac{1}{20}$, and in the second $\frac{1}{10}$. First class roads then would have no grades up which, with a light carriage, a fresh team might not trot at moderate speed, and down which the common speed would be that of the average on a level. And we submit the question whether all the roads of the State might not in time be brought within the limits of the *second* class.

ROAD-BED.

Quite equal in importance to the grade is the surface to be driven over.

Theoretically this should be unyielding, smooth, and impervious to water. It should be a roof, shedding the water each way from the centre, from eighteen to twenty feet wide, except in or near villages, where it may be thirty feet, or even fifty. An elevation of six inches at the centre is required, and the lateral slopes should be *planes*, rather than curves as is usual, that the water may be carried off more quickly. We mean by the "road-bed" simply the drive-way, and this should be as narrow as perfect safety and convenience will permit, on the score of economy, both of construction and maintenance. Bars across the road for turning the water into the ditches are only necessary on the heavy grades of inferior surface, or of such roads as are not kept in good repair; and when needed, should be built V shape, with the angle up the grade, if practicable, that they may strike both wheels at once. An exception to this rule would occur when it is desirable to turn all the surface water to one side; and in that case the slope of the surface would fall one foot in the width of road-bed to the same side. Such a shape of road-bed is desirable in very short turns, as in zigzag roads up steep mountains, and around sharp angles of hills, where the width of driving surface should be a few feet greater, and the slope inward.

The materials of the road-bed must be the best that can be afforded to approximate as nearly as possible to the true theory of a perfect road surface.

The importance of this is evident from the facts established by experiments, that from two to three times as much can be hauled on a broken stone road as on one of gravel, both being in equally good order; and from four to five times as much upon a good pavement of rectangular blocks of stone.

The broken stone road, and the block pavement, have been so long in use, both in this country and in Europe, and in fact throughout the civilized world, and their modes of construction and repair so fully discussed in treatises on road making, even to the minutest details, that it would be superfluous to dwell upon the subject here. It may be remarked however that the Nicolson pavement of wood, or its essential principle which

has been tried in this country now for ten years, bids fair to largely supersede the stone blocks. It meets one great desideratum, among others, of furnishing a less noisy, and more elastic surface than stone.

But most of the roads of the State must be built of loam, clay, gravel, and sand, more or less mixed, and with these materials we must do the best we can.

A road-bed of clay is good in dry weather, and one of sand is tolerable in a wet time, and the latter is but slightly affected by the frost, but we need one which will be good at all seasons.

Not being able to make the surface " water tight," there must be a substratum that will carry the water from above, and that from below, as quickly as possible to the drains. Whatever may be used for this under layer, pebbles greater than one inch diameter should not be placed within ten inches of the surface, for otherwise, when there is a compact foundation, they are sure to work up, from the downward pressure of gravel, forcing itself beneath them. Clean gravel, rejecting stones above an inch diameter, put on in successive layers of three or four inches, to the depth of ten inches, each layer being well worked down with a heavy roller, assisted by the daily travel, with a small admixture of finer gravel or loam upon the top, in some cases will make as good a surface as we can expect for the majority of our best roads.

Pebbles, about an inch in diameter to two or three inches, placed upon the surface, will not pack together, on account of their hardness and smooth, round surface. It is well understood that McAdam and Telford roads are made of *broken* stone —*angular* fragments.

A pure sand road is improved by a topping of clay or loam; and it may be six inches in thickness, or more, according to the depth of the sand.

Quite passable roads have been made in a region where a vegetable mould and loam lay upon pure clay, and no sand or gravel was at hand, by leaving the surface as nearly as possible in its natural state, and flanking with deep ditches, throwing the excavation from them *out*, and not upon the road-bed.

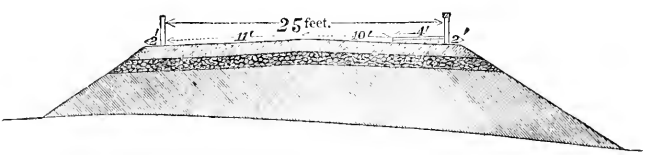
A very good use of stones, if they are abundant, is to place them in a slough that must be crossed. But if it is deep, a better method is to use poles or brush, in alternate layers, first

across and then lengthwise, covering the whole with not less than two feet of the best material at hand. If a layer of two or three inches even of coarse gravel can be put upon an earthen road once a year, it is a great improvement.

Sidewalks should be from four to six feet wide, sloping inwards with a fall of two inches, the top to the depth of six inches being fine and clean gravel, with a very porous substratum like that of drive-way ; there being no danger in this case of forcing up the large pebbles from beneath.

The natural place for sidewalks in villages, and wherever they extend into the country with light road cutting and filling, is by the side of the fences ; but otherwise thay must be at the side of the drive, and form a part of the road-bed, to lessen the expense of construction. In either case the walk should be a little higher than the centre of the drive ; and in the latter, on *gravel* roads, the best way is to give an extra width of road-bed, and lay planks lengthwise upon $4'' \times 6''$ cross pieces, thus giving free passage for the surface water at every point. But away from the vicinity of villages the expense of sidewalks will usually be saved, and the footman will take the drive-way.

Embankments must have a greater width where railings are needed, and these should always be placed where the fill exceeds three feet. The clear width between the railings should not be less than twenty-two feet, and three to five more in case a sidewalk is required, and two feet additional on each side for the strength of the railings. The following cross-section shows the plan upon embankments, with a plank walk on one side, and railings, at minimum width:—



Drainage.

This part of road-building is really the most important of all. A thoroughly underdrained road-surface will not be seriously affected by the heavings of frost, will dry up speedily after rains, and will be passable at all seasons of the year by the average loads, though the materials composing it may be of an inferior

character ; *i. e.*, more depends upon the *drainage* than upon the materials of surface.

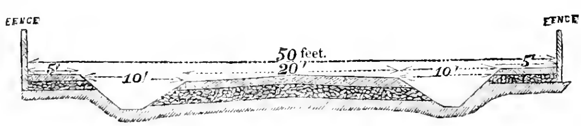
The first thing is to obtain a *substratum* which will drain the surface like a sieve, either into tile drains beneath, or into open ditches at the sides, which should be three feet below the crown of the road, and have a fall not less than eight inches to the hundred feet. This cannot be done thoroughly with *less* than one foot of clean coarse gravel, or pebbles, rejecting all of an inch diameter and less. The foundation for this should be graded with a crown corresponding to the top, that the water reaching it may pass off the more rapidly. The difficulty is that this substratum becomes clogged, and the drainage proceeds too slowly ; or the side ditches become filled up, and the surface is not drained at all.

The best remedy for this is a line of tiles, well laid directly under the centre of the road, lengthwise, three feet deep, communicating with the side ditches where there is a sufficient fill, with the ends properly protected from washing out, or filling up. These should not be needed on banks of two feet and more, but they are especially useful where the road-bed is near the natural surface, or in cuts ; and then the side ditches need not be more than half so deep as otherwise.

Most cuttings have a wet and dry side, and in such cases it would be better to lay the tiles nearer the wet side. The expense of this would not often exceed $1.25 per rod, and in many cases it would be somewhat less ; and there would be a large saving in the digging, and keeping open, of side ditches. There is no doubt that, in very wet places, the tiles would be the cheapest in the end, and they would make by far the best road.

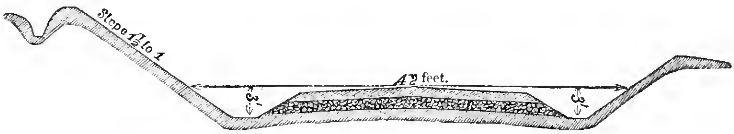
The side ditches should have from one to two feet width on the bottom, the slopes on the inside not greater than two to one, and on the outside an average of one and one-half to one.

The following cross-section shows a general plan for road-bed and side ditches in cuts, and on fills not exceeding three feet. Of course, as the bank rises, the ditches become less in depth.

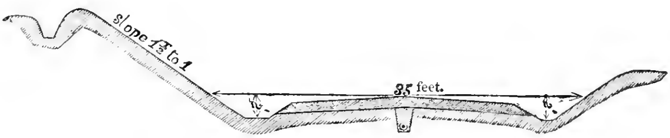


A great saving of water at the side is made by a ditch above the slope of a cut on the upper side, taking the surface-water to the side of the next fill. The dimension of these surface ditches will depend upon the amount of water to be provided for, and their depth may be diminished by depositing the earth taken out on the lower side next to the top of the slope.

The following cross-section shows the plan of a cut, with width of road-bed at twenty feet.



Cross-section, of same cut as above, without a substratum of pebbles, and a line of tiles in the centre, showing a saving in width of cutting and depth of side ditches.



Where no gravel or pebbles can be obtained, the under-draining will undoubtedly make the best road at the least cost.

In cities and villages it is desirable to be able to drive to the edge of the sidewalk; and this will not allow a depression for surface-drainage *exceeding* one foot below the crown, depending upon the width of driveway, and in many cases it should not exceed six inches. Hence, in such cases, a system of under-drainage becomes indispensable, unless there is a very deep substratum of clean gravel or sand.

An increased width of road-bed may make *two* lines of tile-drains necessary, one towards each side; and even in the ordinary width of twenty feet it may be expedient in some very wet places.

On the other hand, the under layer of pebbles will not generally be necessary on banks of three feet and upwards, though it will diminish the heavings of frost, and make a dryer road in the spring.

In side-hill cuts, where much water comes from the upper side, culverts beneath the road should be placed at short inter-

vals to relieve the hillside ditches. All the ditches named should communicate as quickly as possible with natural water-courses, and special care be taken in their construction, that they may not be washed or overtaxed in a freshet.

In general, no work upon a road pays better than that which tends to secure a perfect system of drainage, keeping the water level three feet below the surface of the road. And it may be observed that the vicinity of the road should be kept clear of trees and bushes, as they obstruct the sun and wind and prevent evaporation. Hence shade-trees, set along the margins for beauty and comfort to the traveller, should not be placed too frequently, and only in dry and exposed places.

Bridges and Culverts.

Upon this subject abundant instruction has been published in a multitude of works, both in a scientific and in a popular way, and we will briefly state a few general principles.

The leading point in these structures is to make them *permanent*. Ample provision for the severest freshets—like the one last October—must be made by a careful and exhaustive study of each locality. Above all, secure for these costly structures foundations that cannot possibly settle beneath any pressure they may have to bear, and which cannot be undermined. The safest way is to place them very deep, and heavily timber the bottom if it is at all yielding or treacherous in its nature. Quicksand, the most fickle of all, will support the heaviest of structures if it can be confined. Piling, topped with a platform of timbers alternately crossing, or the tops embedded in a thick layer of concrete, has never failed the engineer when the work has been skilfully done, and properly protected by rip-rap or otherwise.

In cases where a soft material lies upon rock, not many feet below, the excavation must extend to the rock-bed, and this is the best kind of a foundation.

Special attention should be given to the lower ends of culverts to prevent their undermining. This may be effectually done, if necessary, by transverse walls of masonry, or rows of sheet piling, placed beneath the bed of the stream, and the intervals filled with large stones.

A great thing is to give an *abundance of water way*. By

compressing and raising water in its flow, its destructive power is largely increased. Comparatively weak structures will often outlive stronger ones simply by this wise foresight.

It seems more important that these works should be thoroughly built upon highways than upon railways, for the latter usually have more competent supervision after completion.

For the same reason, the superstructure of bridges should be of the simplest kind—that which will need the least care and be most easily repaired. There is no difficulty in making firm spans of twenty-four feet with stringers alone, without braces or truss, provided good timber of that length, fourteen inches deep, can be obtained.

For spans of forty feet and upwards, the "Howe Truss" stands preëminent among wooden bridges; and there are styles of iron bridges, for spans of thirty feet and upwards, which may be the cheapest in the end, if the first expense can be borne. But since there is no danger of fire, we are inclined to prefer the wooden bridge generally.

We will only add that on all bridges of a considerable span, signs, forbidding fast driving, should not only be put up, but, what is unusual, they should be *enforced;* for the vibration caused by rapid driving is tenfold more injurious than the same loads at a walk.

Repairs.

A great deal of money is washed away on our highways for want of constant supervision and prompt repairs. A costly culvert or bridge may be saved by observing the action of the water in time, and applying the necessary remedy.

There is constantly forming in the centre of the drive a horse path, and at the sides ruts, both of which prevent surface-drainage to the sides, and form excellent channels on grades for the water in a rain-storm. Water stands in these at different points, the surface is softened, and they are deepened more and more rapidly; for the blow of the wheel increases with the distance fallen. A great rain-storm comes, the road is gullied, hundreds of yards of good ballast are wasted, and the charge is made to the "dispensation of Providence."

Let the road be divided into convenient sections, and a man constantly employed upon each, with cart, scraper and roller, to

fill up the depressions as soon as formed, keep the ditches open, sharply watch the bridges and culverts, and keep the whole in perfect order. After rains, let him drag his scraper, made of heavy timbers, V shape and shod with iron, over the road-bed to fill up the ruts, cart on the deficiencies in material, and follow with the roller, throwing out the large and loose stones. Thus the periodical repairs would be comparatively small affairs; and, with no more expense, we should have far better roads, and of *constant* excellence. *Now*, a season of repairs is much dreaded by travellers, and it often takes several weeks to get the roads into as good a passing condition as before. One man, by the aid of a team and the implements named, can "keep up" from three to five miles most of the time, provided it is first well constructed.

When general repairs are made, which should be in the spring, and again in the fall, if needed, let the old surface be disturbed as little as possible, as this is firmer than new materials, and let the best that can be obtained replenish the waste. The customary way of scraping out the ditches, and placing the wash of the roads and adjoining slopes in the centre of the drive, is generally the poorest kind of road repairing, for it is loam and sand chiefly that is washed into the ditches. The fresh deposits on the road-bed should be selected, and placed, and worked down, with the same care and labor as of first construction, that the repairs may not for any time be a detriment to the travel.

Superintendence.

It is a cardinal principle that all work should be managed by experience and skill; and this rule is seldom violated by men of intelligence in the conduct of their own affairs.

In Massachusetts, on her fifteen hundred miles of railway, we are told yearly how many passengers and tons of freight are carried one mile, and the average cost of each per mile; but we are left to *guess* at the amount and cost of highway traffic, though it is not much, if any, inferior in amount, and in which the whole population are directly and personally active partners. When this whole business can be reduced to a science, like that of railways, and the results given in tables with approximate accuracy, showing the cost of building and repairing yearly

done for public travel, and the amount and cost of transportation on our highways per item, then we can tell how much money should be expended in this way, and how to use it to the best advantage.

When we consider the great expenditure of the people for public transportation, not only in road taxes, but in time, expense of vehicles, wear, and animal strength, an amount far exceeding railway expenditure, and one borne more directly by all, it certainly seems to be a matter worthy of legislative investigation and supervision, ranking in importance financially above any other public interest in the State.

To constitute an efficient superintendence of this whole interest, making a complete system, operating uniformly throughout the State, and founded upon the most enlightened science and practice of the age, it is suggested that there should be a board of highway commissioners for the State, who shall be appointed simply for their fitness for such a charge, above any political considerations, whose duty shall be, by the aid of a competent corps of engineers, to take charge of the laying out, building, and repairing, of all the public roads in the State ; to fix upon the various plans and principles by which all this work shall be done ; gather facts of traffic upon the different roads, and the cost of the same upon those of different characteristics as to grades and road-bed ; make re-surveys of old ways, with maps and profiles, to show what they are, and how they may be improved ; revise old fence bounds and place permanent land marks ; perfect county records of all its highways, that everything important may be shown there, both to the eye, and in accurate description ; and make experiments upon different grades and surfaces with faithfully recording dynamometers, to ascertain with practical accuracy the draught due to grade and to road-bed, at various speeds, and with vehicles of varied build, four-wheeled and two-wheeled, single and double, with wheels of different diameters and breadth of tires, with and without springs, and in short, under such a variety of conditions, both as to road and to carriage, as to enable the public to advance towards perfection in the art of highway traffic.

It is not suggested to modify materially the present mode of raising and appropriating money for highway purposes, but only to provide a faithful and competent supervision of the ex-

penditure. The plans of the engineers must be approved by the county commissioners, or the towns, as now, before they can be carried out. It would seem, however, that existing laws need to be changed in *two* particulars at least to carry out such a plan as has been suggested. In the place of a jury, in cases of non-agreement between parties, who have power, not only to revise the award of damages, but even to change the plan of the location of a road, the superior court should appoint a commission of disinterested men to examine the case, and simply revise, or confirm, in the matter of *damages*, and nothing else. We have found juries to be very unreliable in such cases. If they can agree, they are almost sure to decide unfairly in favor of the claimants for more damages.

It is also suggested that all the money, or means, raised for highways should be collected like other taxes in "*legal tender*," and none of it in labor. This "working out taxes," as sometimes allowed, is a challenge for shirk and laziness, and a very poor financial scheme. Let the work be advertised, and given to the lowest responsible bidder, so far as it can be done by contract; and put the day work under the charge of thorough and experienced foremen, and the competent superintendent will then make the most of the means at his command.

The importance of some such plan as we have suggested for the skilful engineering and superintendence of our public roads can hardly be exaggerated. The proof of bad management is apparent everywhere in our poorly constructed, and more sadly neglected, public ways.

We are confident that the plan would prove a financial economizer, rather than a bill of expense; and that the people could thus be gradually educated to appreciate better roads, and be made willing to undergo still heavier taxation for the perfection of the system.

It is not intended to suggest in detail the constitution of the "board of commissioners," or the "corps of engineers," above named, but simply that the State does not need any highly honorable and dignified commission to make lengthy and very scientific reports, or a corps of distinguished engineers to ride through the country and give orders, but only a few sensible and practical men, who will understand their work, and do it in the best and most economical manner.

Other Reasons for Highway Improvement.

With the great lines of inland traffic taken up by railways, no less important are the feeders of these, and the supporters of numerous smaller centres of trade, which our highways must ever constitute. Nothing more surely builds up a country town than good roads radiating into a productive farming district. The interest of the buyer and the producer are one in this matter.

Improved roads to market increase at once the value of farm produce, for larger loads can be carried in less time; commercial fertilizers will cost less, as well as every article that is bought for home use. Hence the value of farming estate is enhanced, the more remote from market sharing more equally with the nearer, and the proprietors find themselves paid back fourfold for their road taxes.

A few years since there was a great demand for branch railways, and they were built to some extent, of the same general character as the main lines, and run by the same rolling stock. Of course they have not paid the railway companies, and the towns, or individuals, that helped build them, have not generally received back an equivalent in other profits. All such facilities, as a rule, increase the trade of large centres, and impoverish the smaller ones. The present tendency to great monopolies, and centralizations of trade, do not seem to be promotive of *general* prosperity, intelligence, happiness, or good morals.

Now every town of importance demands not a *branch*, but a *through* line, and they are obtaining authority to raise five per cent. on their valuation for this purpose. We fear many of these investments will prove *sinking* funds, without the hope of resurrection. But something must be done; there must be approximate equalization of transportation facilities. If these cravings are morbid, they must be satisfied in some way, rather than denied.

Are we not overlooking the real cause of the difficulty? Supposing we had such roads as enlightened and practical science, with a wise and prudent expenditure, might have given us, would not the case be far different?

But we are just at the dawn of a new era in railway construction and steam road-traffic. On our main lines, even the waste of carrying so much dead weight has for some time been

discussed. But, without questioning the economy of such ponderous rolling-stock, and the need of hauling so many empty cars on our main routes, or doubting the propriety of hauling magnificent hotels, with kitchens, dining-halls, parlors and state-rooms, at the rate of twenty-five or thirty miles an hour, from New York to San Francisco, we simply wish to notice a new system coming into use for branch lines and those of inferior traffic. With light steel rails, or wooden ones, if the others cannot be afforded ; with smaller and lighter cars and locomotives ; with some idea of making the paying load contribute to the adhesion of the engine, rather than so much dead weight of iron, by combining the power and vehicle in the same carriage ; with tracks laid at the centre or sides of our improved highways, or with broad driving-wheel tires running directly upon the road-surface, on grades as high as the maximum that should be allowed for first-class roads ; and in short, using steam on our public roads as familiarly, as safely, and with as little annoyance, as we now use horses.

Already steam omnibuses are doing good service in the streets of Paris, injuring the pavements less, and overcoming heavy grades more easily, than other vehicles ; and steam is hauling heavy loads with equal success, not only in London, but on highways in benighted India ; and nothing prevents its use here but our poor roads.

The speedy improvement of our public roads, then, not only for ordinary traffic, but to prepare the way for the introduction of steam on the more important lines, will best meet the wants of the towns not on the great thoroughfares, and enable them to put their money to better use than in stocks of expensive railways, which are sure never to pay them dividends, from the very fact that they are called upon to invest in them ; and there are *chances* that the big iron way may prove a way *out*, rather than *in*, for their business.

AMHERST, January 28th, 1870.

THIRD PRIZE ESSAY

ON THE

MAINTENANCE AND REPAIRS OF COMMON ROADS.

By Henry Onion, Civil Engineer.

Introductory.

In order rightly to perform a piece of work, or to accomplish a particular purpose, it is necessary, first, to have a clear understanding of the purpose intended, and then to consider the means of accomplishing it.

There is an urgent demand for improvement in the condition of the common roads throughout the country; and in this State, particularly, the demand is becoming imperative. To ascertain what is required to effect this improvement, it is necessary to look at the defects of the roads as they are now kept, and to mark the difference, in point of construction and maintenance, between good and bad ones in order to know what remedies to apply; also to examine the present system of management to discover where its faults lie, so as to provide understandingly some plan which will secure the most useful results with the best economy.

Present State of the Roads.

The public prints everywhere make frequent complaints of the roads at all seasons, and upon the breaking up of the winter and the roads together, the travelling is described as "horrible." All sorts of suggestions, many of them impracticable or worthless, and some spasmodic efforts, are made to remedy the evil, but generally with very little beneficial effect.

The roads are everywhere bad; difficult to haul over and unpleasant to travel upon. Their defects are obvious to every one.

Except in a few of the summer and autumn months, when they are more or less dusty or littered with loose stone and rubbish, they are muddy, deeply rutted, and frequently, after heavy rains, badly washed and gullied. Water often stands in puddles in the ruts and hollows, sometimes covering the whole surface for considerable distances. They are more or less rough, stony or sandy at all times, and when newly repaired, the material is so applied, or is of such quality, that for long periods travelling is more difficult and dangerous than before any attempt at improvement was made.

They are, moreover, often unnecessarily hilly or undulating, sometimes too wide for economy, but more frequently too narrow for convenience or safety; besides, the surfaces are generally so formed as to invite or compel the travel to follow a single track, confining the wear to one part, instead of distributing it over the whole breadth.

Importance of Good Roads.

We hardly need to urge the importance of good roads, for they are almost as necessary to the existence of a civilized community, as houses are for people to live in.

Without roads we should never have emerged from barbarism; and every improvement upon them contributes to the advancement of the people.

The common roads are the principal means of communication between neighbors, more or less near or remote, of facilitating an interchange of good offices and new ideas; they also permit of an exchange of commodities, and thus in all ways promote the intelligence and prosperity of communities.

They are, besides, tributary to the railroads, carrying the surplus products of industry to the nearest stations, to be transported to distant markets, and, in turn, distributing to us at our doors the freights brought back for home use.

The area benefited by railroads and local markets is extended within certain limits, in proportion to the goodness of the common roads. A man living four or five miles from a market or a railroad station on a very good road is practically nearer than one living two or three miles distant on a bad one.

At the West the writer has often seen two or three yokes of oxen employed in hauling loads that would, on a good road, have been light burdens for single horses.

Characteristics of a Good Road.

The characteristics of a good road are hardness and eveness of surface, with a degree of smoothness which will enable carriages to move with the greatest ease, while affording a sure foothold for horses; the hardness being sufficient to resist the pressure from loaded wheels and the hoofs of animals going over it, but not so great as to prevent entirely an elastic yielding under moving loads. The art of road-making consists, in a great measure, in applying the best means to secure these qualities, and in such a manner as to insure durability against the wear of use and the action of the elements.

Drainage.

The requisite foremost in importance, attention to which cannot be too urgently insisted upon, in the construction or improvement of roads, is thorough drainage; for without this a durable or even a temporarily good structure is hardly possible. Neglect in this particular is one of the main faults of our method of treating roads.

Provision must be made not only for the removal of surface water, but of all excess of moisture from the substratum below the roadway. Under-drains should be laid wherever the soil is not sufficiently porous for self-drainage, and the water tables and side ditches should be so arranged as to carry all surface water quickly away.

The under-drains should be put down in the same manner as for agricultural purposes—say about three feet below the surface, and from eighteen to not more than forty feet apart, according to the character of the soil and amount of water retained by it. Generally, these drains would be arranged longitudinally with the road, but in some cases they may be put across it, in the form of a flat V, the angular point highest, or up the incline on descending grades. This work must be executed with judgment and careful attention to details, to be effective and to save unnecessary expense.

The side channels, or water tables, for receiving the water from the road-surface, should have a fall of as much as 1 in 30; but the inclination should not be so great as to produce violent currents, and at short distances means should be pro-

vided for discharging them of water, to prevent an overflow, or too great a current to the hazard of the road.

Side ditches should be made wherever required, with sufficient capacity and fall to carry away quickly all surface water from the near vicinity of the road, and should have a depth of three feet below the surface.

Catch-water drains are sometimes necessary to prevent encroachments of water from neighboring hill-slopes and the sides of excavations. Suitable out-falls for the drains of every description must be provided, or they may become useless, or perhaps destructive of the works they are intended to preserve.

Culverts.

Culverts for carrying streams under the roadway should be of sufficient size, and be set deeply enough not to impede the natural flow of the water, and, if needed, to help drain the soil near and under the road. It would be better always to make them large enough for a person to enter in a stooping posture, so as to clear them of chance obstructions. Small culverts are liable to become choked, when it often becomes necessary to remove their coverings to be able to clear them. A very common fault is to build them in such a way as to form little ponds on the up-stream side of the road, thus often keeping the embankment saturated with water for long periods.

Effects of too much Moisture on Roads.

It may be thought that so much care about drainage is unnecessary ; but when we consider that the effect of too much moisture is to soften and loosen the soils and all kinds of material used for road-covering, it will be perceived that to this cause is mainly attributable the bad character of our roads. The difference in their condition between spring and summer is an evidence of this fact.

If kept dry at all seasons, the wear of the surface would be very much diminished, and the cost of repairing material consequently reduced.

When the covering of the road is compact and firm, so that the fragments of which it is composed are held fast in place, the wear is necessarily all on the surface, and, if made of good material, it is very slow ; but let it become loosened and saturated

with water, the fragments will be displaced by the wheels of carriages and the hoofs of animals, which will crush and grind them together, so that they soon become rounded or reduced to powder, and need to be replaced by new material.

If roads are thoroughly drained, the action of frost upon them would be very much diminished, and the annual breaking up of their surfaces, produced by spring thaws, would be prevented. The effect of heavy rains, frequently so destructive to water-soaked roads, would be the most efficiently guarded against by means of thorough draining.

Trees and Shrubs on the Roadside.

The roads should have a free exposure to the action of the sun and the winds, in order that moisture may dry off quickly. Hence, natural hedges and trees ought not to be allowed to line their sides in a way to interfere with this object. The dripping from branches, too, hanging over the road is injurious.

Besides overshadowing and sheltering the road, shrubs and trees are often allowed to encroach in such a way as to discommode the travel.

Width of Way.

The width of way between the larger towns, or where the travel is considerable, should be thirty feet, increased, perhaps, to forty feet at a near approach to the towns, but ought never to be less than twenty-five feet.

The first cost is somewhat greater for a wide track; but if the width is not extreme, and the surface is properly covered and shaped, the same amount of material will wear much longer than upon a narrow one.

Upon narrow roads the travel is apt to be confined to one part, thus producing ruts and unevenness, which hastens the wear, while upon a wider one this is not so likely to occur.

Cross-Section of Roads.

The form of cross-section is very important, and one upon which there has been much difference of opinion, some advocating a flat surface, others holding that the surface should be very crowning. These latter urge the necessity of making the centre of the road much higher than the sides, because the

travel goes there, and consequently the wear is mostly in that part. But it is because the surface is crowning that the travel does go upon the centre, for the carriages can stand upright in no other position.

The only useful purpose served by raising the centre is to allow the water to run off at the sides.

If, however, too much inclination is given to the sides, the travel will seek the centre, as before remarked, and that part will soon be worn into ruts and hollows, making conduits and basins for the water there.

For these reasons, practical engineers generally coincide in the opinion that the centre should be but little higher than the sides, and that the best form of cross-section is formed by two straight lines inclined to the sides, connected at the vertex by an arc of a circle of about ninety feet radius. The inclination of the sides ought not to exceed 1 in 30.

The common practice with us is to give the surface a cylindrical form, making the cross-section nearly the arc of a circle, with a short radius, so that the inclination increases from the centre towards the sides. This is the worst possible form, especially when the road is narrow, or, as is usual, the centre is raised very high; for, in order that vehicles may retain anything near an upright position, they must go upon or near the middle of the way, confining the wear to that part; but if the amount of travel is sufficiently great to compel carriages frequently to turn, or to keep upon the sides, they are exposed to accidents by upsetting, and the tendency to slide down the slope increases the wear of the wheels and of the road.

Besides, the labor of the horses is increased by this tendency of the wheels of carriages to slide in a direction at right angles to the line of draught, and the chances of breakage are multiplied by the augmented strain upon their axles.

Gradients.

The longitudinal inclination of roads, where necessary, should be as slight as possible, and ought never to exceed the angle of resistance for the materials of which the surface is composed.

The results of numerous experiments to determine this angle, or the angle of inclination, for different materials, which is just sufficient to cause a carriage standing upon the inclination to

commence moving down it on the slightest application of force in that direction,—are repeated in nearly all treatises upon road making, and need not be re-stated here. The useful deduction from them and from practical experience, however, is that for a well-made road, with a hard and compact surface, the inclination ought not to exceed 1 in 30, and for ordinary gravel roads 1 in 20.

These inclinations are sufficiently safe, but a vertical rise is equivalent to an increased length of road proportional to the angle of inclination. From calculations made by means of a formula deduced from experiments tested by Sir John Macneill, it is shown that a goods wagon of six tons burden, drawn three miles an hour upon an inclination of 1 in 30, one mile is equivalent to 2.7 miles level road; and for a stage-coach of three tons drawn six miles the equivalent level road for one mile is 1.62 miles.

The amount of force expended in conveying a given load over a road from one point to another at a higher elevation, is equal to the force of traction plus the force necessary to lift it up to the elevation reached: thus if the load is carried two miles, and the terminus is a hundred feet higher than the starting point, it has to be *lifted up* that hundred feet, as well as hauled the two miles.

Any intermediate descents will not compensate for the rise, but will add, by carrying the load to a lower level, to the ascent to be made.

The difficulty of making the ascent will be in proportion to its inclination, and it will be necessary to start with a team of sufficient strength to climb the hill, which would be greater than would be needed on a level, or descending road.

The road-covering upon steep inclinations is liable to be torn up by the hoofs of the animals making extra exertions to ascend with heavy loads, and is more subject to injury from deluging rains, in proportion to the pitch of inclination. Hence hills should be avoided or reduced as much as possible.

These considerations are apt to be overlooked by persons ordinarily having charge of improvement, or the construction of roads, or otherwise they might be amended by material reduction of grades, and generally with very little extra cost.

Grading of Roads.

The finished road consists of two distinct parts: the sub-road or road proper, and the covering. The sub-road is first graded up to within about a foot of the intended finished surface, and its surface shaped and prepared to receive the covering.

It is also important that the embankments should be made in a solid and substantial manner, care being taken not to put into them vegetable matter, or decaying substances of any kind to endanger their stability, or to cause unequal settling.

In cases where the sub-grade runs near the surface of the ground, the sods must be taken off, and all roots and stumps removed.

Mucky earths must be replaced by material fit for a solid foundation.

Ledges should be excavated to a depth of one foot, at least, below grade, and the surface dressed so as to leave no hollows for holding water.

The sub-road should have the same cross-sections as the surface of the finished way, so as to shed any water that may percolate through the superficial coating, and in order that the covering may have the same thickness throughout.

Foundations for Road Covering.

That part of the structure lying immediately under the road covering may be termed the foundation, and upon it, in a measure depends the durability of the covering, and the ease of travel.

As shown by Sir John Macneill's experiments, before mentioned, the force required to move a ton, on a broken stone surface, on a bottom of rough pavement, is forty-six pounds; while upon a broken stone surface, laid on an old flint-road, it is sixty-five pounds.

The covering may be laid directly upon the ground without further preparation, than above indicated, or a foundation may be made of concrete, or of rough-paving.

Many of the military roads of the Romans were constructed upon a concrete foundation, some of which have endured to this day without being entirely worn away.

The use of this foundation, was introduced into England not many years ago by Thomas Hughes.

It is made of gravel and lime in the proportion of five or six parts of clean gravel to one of lime. The lime is finely ground, the materials thoroughly mixed, and the concrete is made on the surface of the road.

The depth of the concrete bed when applied is six inches; upon which a layer of stone or gravel three inches in depth is spread, before the concrete has set.

Afterward, and before the travel is permitted to go over it, another layer of material is spread, and the whole consolidated by rollers.

In some instances the concrete foundation has been successfully tried in cases where no other means were effectual in making the road solid.

The method of making a foundation of rough paving introduced into England by Mr. Telford has been extensively used in Europe, and to some extent in this country.

This is formed by laying down broken stone of not more than twelve inches in their greatest dimensions, nearly parallel-sided, and not more than seven or eight inches in depth.

The stones are laid close together broadest side down with the longest way across the road, and then are wedged together with thinner stones and chips, after which projecting points are broken off with a hammer, and the surface evened by filling the hollows, and crevices with stone-chips.

Road-coverings based upon foundations of paving, or concrete are so superior, and so much more durable as to justify their use wherever the traffic is large, and the saving in the wear of material and the labor of repairs will, in time, more than compensate for the extra cost of constructing.

They receive the pressure from loads, transferred by the fragments composing the covering, without yielding; thus checking any tendency to movement amongst them, and prevent their being forced into the soil below, and the soil from working up, and mixing with them.

With such foundations a less amount of material will be required for the covering, which need not exceed five or six inches in depth, whether made of broken stone or gravel.

The covering placed upon the earthy surface, with no intervening stratum, will need a depth of eight or ten inches, and

cannot be worn so thin as when upon an artificial foundation without re-coating.

The purpose of covering roads is to obtain by the use of appropriate materials a uniformly hard, even, and unyielding bed, that will resist wear, and afford a smooth surface, which will offer the least resistance to the motion of the wheels of vehicles.

Covering of Roads.

As the covering receives the shock, and suffers the attrition from the hoofs of animals and the wheels of carriages, it needs to be made of such substances as will best resist crushing and abrasion.

The excellence of the road depends upon the characteristics of the covering.

The materials usually employed in forming it, except in large cities, or where the traffic is very heavy, are broken stone and gravel.

The foundations of concrete and stone, when completed, are ready to receive the coating ; but it would be a great deal better to prepare the earth foundations by compressing the surface as much as possible with heavy rollers.

The stone used for covering should be selected with care, to secure such as is both hard and tough, and broken into angular pieces, such as may be passed through a ring two and one-half inches in diameter and down to one-third of that size, but no smaller.

The broken stone should be kept clean, and in handling, a pronged shovel should be used, to prevent dirt from getting mixed with it.

When used on artificial foundations, it is to be spread evenly in layers over the whole breadth of the road, the bottom layer three and one-half inches in thickness.

The first layer ought then to be compressed firmly with rollers sufficiently heavy for two horses to drag, when the top coating, of two or two and one-half inches, should be applied, and rolled down in the same manner as the first.

Finally, a coating, of about an inch in thickness, of small gravel should be spread over the surface, and the whole consolidated with rollers weighing from six to ten tons.

During the rolling, the surface must be kept even by filling

any hollows or raking down any bunches that may make their appearance.

The object of covering the surface with gravel is to fill the crevices between the fragments of stone, to help hold them fast in place, and to reduce the shock upon the wheels from striking the angular points of the stones, by preventing them from falling into the cavities. When finished, the surface should have solidity and smoothness sufficient for a horse and carriage to trot over it with ease.

The same process is required for covering a road-bed which has no artificial foundation upon it, except that the *thickness* of the layers should be increased, or the *number* greater. Gravel consists of small fragments of stone, more or less rounded, and as found inland, is generally mixed with sand or loamy earth, while that obtained from sea-beaches is usually free from extraneous matter. It varies greatly in quality, and it is difficult to find, in its natural state, suitable for road-covering. For this use it should contain no pebbles of more than one and one-half inches, or less than three-quarters of an inch in diameter. It should be free from sand, but must contain a proportion of binding material of a loamy or clayey character.

It is generally necessary to prepare it for use by screening, to separate from it both the larger pebbles and some of the finer stuff, when that is in excess. When gravel is of excellent quality, or it is properly prepared, it makes a superior road-covering, for which purpose it should be spread in layers and consolidated in the same way as that described for broken stone.

The covering materials should be kept moistened, by sprinkling or by the state of the weather, while being compressed under the rollers, but the rolling should not be done when they are saturated with water.

It is usual to admit the travel upon the loosely spread materials, and make it do the work of binding them into place, which it will never do so perfectly as might be done by rolling. The wheels act as wedges, forcing themselves between and displacing the fragments which are crushed and abraded under the loads; mud and dust works into the interstices, so as to prevent the parts from wedging or being bound together; horses' feet are liable to injury from loose stones; the rims of wheels are rapidly worn; riding in carriages, too, is very uncomfortable, and

without extreme care, the surface will become rutted and uneven. Thus, before the road has become settled, the discomforts and disadvantages outbalance the cost of rolling.

The use of the steam stone-crusher and the introduction of the steam roller would greatly reduce the cost of preparing and applying road materials; and the employment of these and other machines of like character would be a step towards great improvements in the common roads.

Relative Merits of the different Road Coverings.

Having briefly indicated the different methods of construction, it is proper, before considering the subject of repairs, to compare the relative merits of each.

There are three points especially worthy of consideration in determining what kind of road to build; or rather, as that is the important feature, what kind of covering to use, namely: the first cost, the cost of maintenance, and adaptedness to the use intended.

The fitness of a road for its use of course depends upon the kind and amount of traffic going over it; for one much travelled by heavily loaded teams will need a more substantial and expensive covering than one used chiefly for light carriages; and consequently judgment is required to avoid deficiency of strength and solidity, on one hand, and unnecessary expense on the other.

The comparative original cost of covering a road would depend in some measure upon the kinds of material most procurable in the vicinity, or the distance to where the kind needed must be sought; but generally the broken stone covering, with a paved or concrete foundation, is the most expensive. The next in order, as regards the first cost, is a broken stone covering laid upon earth, though the difference of this from the first mentioned, in that respect, is not great.

Gravel is the cheapest of all materials for finishing roads, when it can be obtained, of good quality, from a reasonable distance, and can generally be most easily applied.

It would appear, however, from experiments made by Mr. Wm. H. Grant, superintending engineer, upon roads constructed by him in Central Park, in New York, that the relative cost of them was for

Gravel upon a paved foundation, ...	1
Broken stone upon a paved foundation, ...	1.65
Broken stone upon earth, ...	1.70

Broken stone roads are designated, respectively, those having paved foundations, Telford, and those laid upon earth McAdam roads.

For general traffic, the Telford road is undoubtedly the most durable, and can be maintained in high condition, at less cost, than any other. The foundation is permanent, and, with a proper depth of materials perfectly consolidated, the whole will always remain intact, except from the wear upon the surface.

The macadam way is more liable to be broken up from the yielding of the earth foundation on which the materials rest, thus subjecting them to a tendency to motion among themselves under heavy pressures. Any uneasiness of the fragments causes the soil to work upward, so as to help loosen their bonds ; therefore the wear would not be confined to the surface, and the necessity of replacing them would be more frequent.

Gravel upon a paved foundation, thoroughly consolidated before use, doubtless makes the best and least expensive of really good roads for light carriages. They are well adapted to localities where there is but little heavy traffic, and can probably be kept in repair, in such situations, with as little cost as any other.

According to a statement made in the "Engineering and Mining Journal," by Mr. Grant, before quoted, a sample road made in Central Park in this way, remained in perfectly good condition, after nearly five years constant use, during all of which time it has required no repairs, except at a point where the gravel became loosened and uneven by the turning of carriages about a short curve.

Roads made of gravel on earth foundations are less fitted for general travel than any of those mentioned, and though cheaply constructed are the least useful and most expensive in the long run, requiring a frequent renewal, or constant patching of the covering, to keep them in tolerable order.

Earth roads made and repaired with plough and scraper are hardly worthy of mention except as temporary expedients in new settlements, though they are not uncommon in the oldest parts of the country.

In economy of repairs, the roads having artificial foundations for the coverings, and otherwise thoroughly constructed, are superior to any others. The saving in the expense of their maintenance will generally in a little time compensate for the excess of original cost. In economy of use they are superior in offering less resistance to draught, thus allowing greater speed to be made and heavier loads to be carried with the same animal power.

Methods have been contrived for measuring with accuracy the force required to haul loads over different kinds of road surface, or up and down different inclinations at the various ordinary speeds of travel for all sorts of vehicles used. With these many experiments have been made, and the results generalized by means of formulas so as to be applicable to any particular case.

Some of the results obtained from experiments made by M. Morin at the expense of the French Government, are as follows:—

1. The traction is directly proportional to the load, and inversely proportional to the diameter of the wheel.

2. The width of the tire, if above three inches, does not affect the traction upon paved or hard macadamized roads.

3. There is no difference of traction for carriages with or without springs going at a walking pace on the same road.

4. Upon hard macadamized, and upon paved roads, the traction increases with the velocity; the increase of traction being directly proportional to the increase of velocity if greater than two and one-fourth miles per hour. The increase of traction arising from an increase of speed is less in proportion to the smoothness of the road, and the lightness with which the carriage is hung.

5. Upon soft roads of earth, or sand, or turf, or roads fresh and thickly gravelled, the traction is independent of the velocity.

6. The traction, at a walking pace upon a well made and compact pavement of hewn stones is not more than three-fourths that on the best macadamized roads.

7. Carriages without springs are more destructive to roads than those with them, and the less the diameter of the wheels the more destructive they are.

Sir John Macneill, with an instrument for measuring forces required to haul loads over different surfaces, obtained, from

many experiments, the results contained in the following table; inserted here for purposes of comparison. The wagon used weighed twenty-one cwt., and the resistance to draught was:—

On a well-made pavement, ...	33 lbs.
On broken stone laid on pavement or concrete foundation, ...	46 "
On broken stone laid on earth, ...	65 "
On a thick coating of gravel laid on earth, . . .	147 "

These and many other like experiments made in France and Great Britain point clearly to the great superiority of the best broken stone roads, over those made of gravel and loam in the ordinary way. More will be said bearing upon this subject further on.

Suitable Persons to have charge of Roads.

To secure such kinds of structures as have been described, or to make material improvements upon those in existence, it ought not to be necessary to intimate that the work must be done under the direction of practical road-makers, whose education and training fit them for such duties. But the common practice of entrusting such work to those who are not only wholly ignorant of the mechanical principles necessary for the achievement of success, but who have had no experience useful for the duties required, seems to indicate that this consideration is not appreciated.

An extensive knowledge of scientific principles is necessary for the successful practice of the engineering art, of which road making is not the least difficult or important branch. An acquaintance too, with the processes and expedients, whether successful or not, employed by men who have achieved eminence in their profession, is needful to help mark out the right path, and to hint at the direction in which to look for resources in difficult emergencies. No art can, however, be learned from books alone, but the skill to execute, the ability to judge of the qualities and fitness of materials, the ingenuity to overcome difficulities, and the readiness to find and adopt methods of operation suited to each particular understanding must be acquired from practice.

A cavalry man detects at a glance the good points of a horse;

no defects are concealed from his scrutiny; he knows how to correct his faults, how to feed, and groom him, so as to fit him for service, and he can guide and manage him in a manner to make him most useful. All this is a mystery to the foot-soldier who can see none of the beauties, or faults of the horse; he knows nothing of his qualities, and can hardly distinguish one animal from another.

None but a farmer will undertake to breed stock, or grow crops; a blacksmith does not attempt to make glass ware; then why should an ignorant day laborer, as often happens, be employed to make and repair roads?

Improvement and Repair of Roads.

It has not been thought necessary to state in detail the process of doing the work, or to describe minutely the materials to be used, to do which would require a volume, as there are many excellent treatises upon road-making, which are easily accessible to those who wish to pursue the subject. The object here is, as clearly as possible, in a brief space and limited time, to point out the public needs in regard to roads, and to suggest the best means of supplying them.

In pursuance of this purpose, we will now, at the risk of some repetition, proceed to state, in a general way, what is required for the improvement of the present roads, and to consider what ought to be done to maintain them in first-rate working condition.

Many of the old roads upon which reduction in grades, or changes in direction are not needed, may be easily improved. With some trimming of the sides, shaping, and evening of the surface, being solidly compacted by years of travel, the beds of these roads will serve as a good foundation for covering with either of the kinds of materials mentioned. If gravel is used it must be carefully selected, and a coating of the material as it comes from the pit, only removing the larger stones, should be spread evenly to the depth of three or four inches over the whole surface. It should then be raked smoothly, and solidly compressed by a roller drawn by two horses.

Over the first layer after it has been sufficiently hardened, a second one two and one-half inches in depth, consisting of screened gravel, is to be put on and treated in the same manner,

when the whole should be thoroughly consolidated with rollers of five or six tons weight. If then the drainage is properly attended to, the roads will become nearly equal to the best, and with watchful care, may be kept permanently so, with small cost, in comparison to the present outlays for patching and repairs. A saving might be made by putting on both layers unscreened, but the road would not be so perfect or durable; besides this, the greater ease and comfort of travel upon the screened gravel, and the difference of wear would doubtless repay the cost of screening.

Upon places where the old road is not sufficiently firm—being either sandy or loamy—a foundation of rubble-stone may be laid to the depth of eight or nine inches. The stones used for this purpose should be angular, having no dimensions greater than twelve inches or less than three inches, and should be carefully and closely laid together, the longest way across the road.

The surface should then be evened by spreading stone chips over it, when the gravel may be put on and treated as described above, except that an additional layer will be needed to guard against a movement among the loosely deposited stones below.

When the roads are already in tolerable good condition, with a good gravel surface, nothing more perhaps will need be done than to dress them into proper shape and to fill the hollows and even the surface. If however the surface is much worn into ruts and hollows, or the gravelly coating has become thin, a layer of two or three inches of screened gravel should be spread evenly over the whole of it and rolled solid.

In situations where gravel of suitable quality cannot be obtained, or upon roads much frequented by heavily loaded teams, broken stone must take its place in the work of renovation. In such cases the surface of the road must be newly shaped, in the same way as for gravel, taking care not to break it to a greater depth than just sufficient to give it the proper form and to make it even. The manner of applying this material to the old road-beds is the same as has already been described.

In all cases, the mode of proceeding and the precautions to be taken are the same for the old roads as for the new. Wherever the travelled part of the road is not of sufficient width, it should be made so before being coated with surface-materials,

and the sides or centre, as the case may require, should be reduced to obtain the proper cross-section.

Shrubs and trees growing upon the borders, not intended for ornament, should be uprooted, and the heaps of stones and rubbish that so commonly offend the sight and sometimes obstruct the way, should be removed.

The Cost of Improvements and their Benefits.

No one acquainted with the present wasteful and thriftless way of dealing with the roads, can doubt that they might, under a more effectual system of management, be gradually brought to a high degree of excellence, without an increased outlay of expense ; and some facts will be presented hereafter, going to show that they can be maintained, in a superior condition, at even less than the present cost.

The importance of bringing up the public roads to a high standard of excellence, and of constantly keeping them in that condition, has been sufficiently urged, and is perhaps generally well enough appreciated ; but the possibility of doing so with reasonable economy, or without, as might be apprehended, a largely increased expenditure, might, on the first thought, be questionable.

But we have seen how a great saving from the present expenditure of money and labor upon the roads might be made by a proper application of the work, and that any additional cost contracted for construction would be, as well for their better adaptation for use as for the purpose of making them, very much more durable, and consequently as much less expensive to keep in repair.

Besides, the well-made and well-kept roads would be greatly superior for the purposes of transportation and travel, since very much heavier loads could be conveyed by the same expenditure of animal power, and valuable time be saved by higher speed.

It would be safe to say that a saving of twenty-five per cent. in animal power alone would result from the proposed improvement of the roads. In these considerations, the gain from diminished wear of vehicles and harnesses, and the incalculable saving of oaths, impatience and ill-temper, have not been taken into account.

There can hardly be a doubt, from these considerations, that

the people could afford to pay even an increased tax for extensive improvements and the support of all the public roads, and still be gainers by the reduction in the cost of traffic that would result.

Roads in Europe.

The advantages of improvements in public roads by skilful reconstruction, and by watchful and unintermittent care for their preservation, has been tested in several countries; and on the Continent of Europe systems of intelligent superintendence have long been established, always with the best economical results.

The following statements of facts are quoted by Gen. Sir John F. Burgoyne, in his "Remarks on the Maintenance of Macadamized Roads," from papers written by Monsieur L. Dumas and other French engineers of the Corps des Ponts et Chaussées:—

"The following took place with respect to the high roads (Routes Royales,) of the Department de La Sarthe, somewhat less than two hundred and fifty miles in extent. In 1793, a demand was made to put them in complete order, £15,280, or £60 per mile; in 1824, the demand was £9,000, or £36 per mile; in 1836, the demand was £7,760, or £31 per mile; in 1839, the demand was £6,640, or £26 per mile; and the roads have become better concurrently with the reduction of cost of maintenance, from being, in 1793, in deep ruts, to 1839, when they were in very good order.

"Part of the great road between Lyons and Toulouse, till 1833, was always in a dreadful state, and yet cost habitually about £110 per annum per English mile for maintenance, when M. Berthault Ducreux introduced a system of patching, instead of general repairs, since when the road was greatly improved, till it was in a *very good state*, and the annual expense reduced by £13 or £14 per mile.

"Another instance is quoted, where, prior to 1837, the average amount of broken stone laid on thirty-three miles of road was 6,000 cubic yards; under the improved system in 1837, 5,000 cubic yards were applied, in 1838 only 1,350 cubic yards, and 1839 *none*. In another instance the cost has been as follows for the expenditure:—

YEARS.	Materials.	Road Labor.	Total.
1830, ...	£548	£166	£714
1831, ...	563	188	751
1832, ...	496	151	647
1833, ...	500	167	667
1834, ...	438	177	615
1835, ...	398	145	543
1836, ...	380	160	540
1837, ...	360	178	538
1838, ...	180	233	413
1839, ...	250	300	550

" In 1837, when it was taken up in the new system, the road required considerable improvements; in 1840 two-thirds of it were in perfect condition, and when the whole is reformed, it is calculated that from £400 to £440 will keep it perfect.

" The road from Tours to Caen in La Sarthe was, in 1836, in so bad a state as to be in danger of becoming impassable.

" In January, 1837, it was passed under the charge of M. Dumas. The average annual expenditure for the five years prior had been: for material, £736; for road labor, £242; total, £978. From 1837 to 1841 the annual average for material was £375, labor, £443; total, £818. In 1841 the cost of material was £163, for road labor, £445; total, £608. In 1838 this road was reported to be in a very good state, and since then has become better and better.

" In 1834 the mail required always *five* horses, and the road was so bad that the postmaster *lost eleven* horses by the hard work in *one year*.

" In 1838 the number of horses was reduced to *three*, and at present there are only *two* of *middling* quality, and the postmaster loses *none* from that cause.

" In this same district, in consequence of improvements in these roads since 1839, a number of lighter carriages have been estab-

lished; they have four wheels and are drawn by one horse, carry nine persons, and go seven or eight miles an hour. Previously the carriage for the same number of persons, had two wheels, two horses, and went much slower."

At the time these statements were made, these French engineers calculated that by maintaining the roads in the best possible condition, which they assert can be done without increased expense, the cost of draft of merchandise over the roads in France might be reduced one-third, or about $30,000,000, saving that amount to the public. From the foregoing statements it will be perceived that the cost of labor upon the roads is increased, while the cost of material is diminished by the system of constant care.

The inferences to be drawn from them, and from experimental tests, all point the same way as the suggestions of reason, and from experience gathered from the practices observed in this country, namely, that the best public economy and convenience would require that the highways should be maintained in the best possible condition. The cost of maintenance including improvements, would not be increased, the wear and tear of carriages and harness would be diminished, there would be a saving of time, by increased speed, less cruelty to animals, and far greater comfort in travelling.

Defective System of Management.

It is useless to attempt to improve the condition of the roads except with a change of system, or rather by the substitution of a system for the hap-hazard way the work is done. Constant care and oversight is required, and workmen should be employed to be on the road all the time, to keep the surface clean, and to repair any injury or defect as soon as it occurs.

The importance of cleanliness is illustrated by some experiments made by M. Morin, showing that the resistance to draught upon broken stone roads is four times as great with deep ruts and thick mud, as upon a good one, and is greatly increased by the muddy or dusty condition of otherwise perfectly good roads.

The way Roads are now Mended.

The laws of Massachusetts relating to the maintenance of the highways, however well adapted to *colonial times* when the coun-

try was thinly settled, and money hardly to be had, are totally unsuited to the present age with our dense population and abundant means. The towns are required to choose annually one or more surveyors to make repairs on the roads, and the custom is to elect from one to twenty or more, according to the territorial extent of the town, or the caprice of the voters.

To each surveyor is assigned a certain portion of the road-tax either in money, or in days' labor, according as the town determines that the tax shall be paid, and he proceeds to expend the same upon the roads allotted to him, exercising his own discretion about the time and manner of doing his work, and using his own judgment, if he has any, of the kind of work required.

The time he chooses is generally when he has the most leisure, and whether required or not, he frequently works out his money at once, and gets done with it. The work is often performed in the rudest manner, and the road is coated here and there with thick patches of worthless stuff—better suited for top-dressing for crops, perhaps, than for road material—to be washed into the gutters on the occurrence of the first heavy rain. From want of judgment, or want of interest, the money is wasted, and the people are burdened with the heavier tax of struggling over hard roads, made worse by the money they have paid for improving them. Less frequently a man is chosen, who understands better what is needful to be done, and with what means he has, he commences some improvements, which if followed up in after years would result in a public benefit, but his office is only for a year, and he may be followed by a man to undo, what was well begun.

Our people do not manage their *private affairs* in this thriftless way, neither is any other public business conducted so loosely or wastefully, and it is a wonder that these evils have been allowed to continue so long as they have.

A few towns have tried to remedy these evils, with some measure of success, by appointing a superintendent to have charge of all the roads in the town, and keeping a corps of workmen, with horses and carts constantly employed in making repairs.

The public moneys are contributions from the surplus earnings of the industrious brains and hands of the Commonwealth, and should be expended in the best discoverable manner, to secure

the greatest public benefit. The people ought to require that these important trusts shall be confided to none but such as are fitted by skill, intelligence, and integrity, for the duties assigned them; and the laws should be so framed that the money provided for important public purposes shall not find its way into wasteful and incompetent hands.

Proposed System.

For the efficient and economical maintenance of the public roads, it is essential that there be a uniform system of management common to the whole State. The first step towards a complete reform of system would be the creation of a State department of roads and bridges, to have general charge of all the roads, to arrange and direct the carrying out of the details, and generally to look to the effective working of the system.

The chief of the department should be a practical civil engineer, thoroughly conversant with the art of road making. For the purposes of proper supervision, the State might be divided into districts, say by counties, and these again into sub-districts, larger or smaller as might be found expedient.

There should be a resident engineer or superintendent for each district, to have charge and oversight of the roads and bridges, within his district, and to be held accountable to the chief of the department.

He will ascertain the condition of the roads in his district, determine what improvements are to be made and in what order, decide upon the kinds and amount of work to be done, estimate the sums needed to carry it on, and at stated periods report the same, with all other matters pertaining to his office, to the chief of the department.

For each sub-district there will be required an assistant-engineer or road-master, subordinate to the resident of the district, to manage the working details, within the limits assigned. As the improvements progress, these sub-districts may be enlarged and the number of subordinates reduced, so that each and all shall always have work enough to keep them occupied.

By some method of this kind the standard of excellence and the manner of treating the roads would be uniform; any suggestions of experience could be taken advantage of; the use of improvements in implements and machinery could be everywhere

extended, and a system of strict accountability maintained throughout the department.

The public could thus enjoy the benefit of the skill and ingenuity of educated talent, which under town management is scarcely possible, and the people would be assured that their money would bring them beneficial returns instead of being wasted by mischievous incompetence.

Under a general system, stone-crushers, steam-rollers and other costly machinery might be employed, and other means of economizing labor adopted, that towns cannot command. Suitable materials for road making could be prepared at the most convenient places, or where found of a superior quality, without reference to town lines. Towns cannot individually provide for a competent supervision of the roads, an advantage which a general system insures.

The details of the system might be arranged as found most expedient, or as would best accord with the prejudices and habits of the people.

The tax levied for the roads might be paid into the State treasury, and the money expended for the best advantages of the general public, or allotted to the districts according to their relative needs, or it might be paid to the county treasurer, to be expended within the county, or again it might be collected as now, and expended wholly in the towns where raised.

Details of Working.

Either of two methods might be adopted for doing the work upon the roads. Gangs of hands working together may be assigned to districts of such extent as they can go entirely over in limited periods and do the work needed; or men may be stationed singly along the line, each with the length of road that he can properly look after.

The workmen, in either case, would be subject to the oversight and direction of the road-master or overseer of the subdistrict. Parties working in gangs would each require a horse and cart for their use, and would do all the necessary work of cleaning and repairing the roads; but the duties of preparing and distributing materials to depots convenient for use, of removing the road-covering where worn out, of rolling the surface, &c., would require to be performed by distinct parties. The

materials to be used for patching, after being carefully prepared, should be hauled to points convenient for the use of the repairers, and deposited in depots prepared in such a way as to prevent earth or other deleterious substances from becoming mixed with it. These depots might be formed by enclosing suitable spaces by a wall of rough stone.

The men stationed singly,—the *French cantonier*,—under the system of assigning to every repairer a certain length of line, will each need to be supplied with a wheelbarrow, a pick, a shovel and a scraper.

These suggestions of details are only made to indicate how the proposed system may be made to work practically; but the experience that would be acquired under the system would in a little time lead to the simplest and most effective plan of operation.

How the System will Operate.

This system of management of the common roads which it is proposed to substitute for the one now in operation, is doubtless the best that can be devised to effect a permanent improvement of the highest character upon the roads, with the most economical expenditure of labor and money.

It provides for the responsibility of every individual having supervisory charge of the roads, by holding each in order accountable to one next higher in rank, and with a provision for a method of making payments at stated periods, upon pay-rolls and written contracts, by officers assigned to such duty, which should be included. Peculation and embezzlement would be guarded against, and a draining leak of some magnitude in the public purse would be stopped.

Under such a system, every officer of the department would, from a care for his own official and professional reputation, require that his subordinates should all be men of capacity and intelligence, who, from fear of dismission, if otherwise disposed, would not dare to be remiss in duties. If, however, there should be any hesitation about making all at once a change so sweeping, and the adoption of a new system should be delayed from any cause, it seems very desirable that a department or a commission should be established to act as an advisory board, helping the towns, if possible, out of some of their perplexities in regard to the care of their roads; to collect statistics and ar-

range them, and to gather facts and compare them, so as to furnish information, in a systematic form, upon which to base future legislation, and in such other ways, as may be found useful, to promote the object of improving the character of the roads throughout the State.

Reliable information upon nearly every particular in regard to the roads is needed. It would be useful to know the number of miles of roads there are in each town in the State, the cost per mile for keeping them in repairs, and how made, what materials are used, the condition of the roads respectively, &c.

It would be well, too, to know, in this connection, what, in the several parts of the State, is considered a load for a horse, and what is the average rate of speed, with fair driving, for light carriages.

There occur other useful inquiries which might be made, such as: what number of surveyors are usually chosen? whether steam-crushers or rollers are used? what damages, if any, the town has suffered from defects in roads and bridges? &c.

Intelligent answers to these and like queries, which the commission in question might be authorized to obtain, would naturally help the judgment in deciding what legislation is necessary.

Good Workmen and Neatness.

A reason not before mentioned why the system here advocated should be substituted for the present one, is that under it the laborers would be selected for their intelligence or aptitude, and those proving superior workmen would be retained permanently in the service; they would soon become expert in their duties, and do their work with celerity and neatness. The performance of a good workman will have a neat and finished appearance; or as the phrase is, a workmanlike look.

There is no excuse but stolid indifference, for the slovenly, and unsightly appearance of the borders of many of our roads. All rubbish, dead leaves, and loose stones should be removed from thence, and not allowed sensibly to accumulate. This duty should be strictly required, so that the track-way should be kept in order. The waste matter from the surface of the road and the gutters is valuable for manure, and if swept into heaps, would be carried away gladly for its worth by people living near, but in no case should it be thrown out upon the sides.

The slopes of the cuttings and embankments, ought to be neatly trimmed, and grassed over, and not be permitted to wear the ragged look now too common. The cost of keeping the borders of the roads in this way would be trifling, and would influence the residents upon them to keep their grounds, and dwellings in a better condition. A man will dress better, and use choicer language, when among gentlemen than when among clowns.

This system is intended to apply only to the highways or county roads. The care of the town roads, those established by the town for local convenience, may be left, as now, if thought best, in the hands of the town authorities.

County Commissioners.

The present method of laying out new roads, or altering the lines of the old ones by the county commissioners need not be changed, except that for a projected new road or alterations, the surveys, maps, profiles, estimates of cost, etc., shall be made under the direction of the chief of division, or resident engineer, of the county or district, and when ordered the new road shall be constructed, or the old one rebuilt under his charge. At present the county commissioners are liable to make mistakes in the location of roads, sometimes involving needless expense in their construction, and do so by establishing inferior routes, with steeper slopes than need be, or with greater deviations than are demanded by public interests or required by the nature of the ground. Not appreciating the importance of employing a competent engineer to ascertain the best route, and therefore not feeling justified in incurring a slightly greater expense, or being willing to gratify an importunate neighbor, they generally get a land surveyor, who knows nothing of road making, to mark out the line and to determine (rudely perhaps) the elevations along it, as well as calculate in a rough way the cubic contents of the cuts and fills, and reserve to themselves the duty of drawing up specifications which vaguely indicate the manner in which the work shall be done. It is next to impossible in this way, to avoid making mistakes. No one with an unpractised eye can select the best ground, where there is any choice, upon which to build a road, nor can any one with the use of instruments, without skill acquired from practice, fix upon the most feasible line

without much unnecessary labor. The commissioners are usually men of other professions and share probably the mistaken estimation in which engineers are held by the public generally. The common impression that engineers are extravagant, and that they look only to the achievement of ends, without regard to expense, is exactly the reverse of the fact. Their great aim and study is economy; economy in every form consistent with durability and adaptedness for use; economy of money, material, time and labor. This may be said to be the secret of the profession. Without this economy very few of the great modern works would have been accomplished; for it is only by applying labor and means to the very best advantage, and arranging costly materials in structures with scientific accuracy, so as to secure the greatest strength and durability, with the least possible expenditure of materials, that such works have been made practicable, or perhaps possible.

Should the system here proposed not meet at once with a favorable consideration, it is to be hoped that some different way of constructing new roads will be adopted. Let there be a resident engineer appointed for each county, who shall be employed by the commissioners to make the necessary surveys, &c., for projected roads, and superintend the construction according to a standard fixed by law.

If the people were as clamorous for good roads as for new ones, there would be less call for new ones, and the whole community would be benefited.

Another and final reason for the adoption of some system of responsible superintendence in the construction and care of roads, is that streams are often obstructed and their habits changed, by the improper location or construction of bridges. Much injury sometimes results from these causes. In flat lands, upon slow-flowing streams, large tracks are sometimes flooded more, and for longer periods, from a deficiency of water-way under a bridge, or some other mischievous interference with the natural current by the structure. In hilly regions, the bridges themselves are sometimes swept away and great injury is done to property on the borders of streams, from ignorance or carelessness in cramping a swollen torrent into too narrow a space by the misplacement of the abutments and piers of bridges, in order to shorten the span a few feet.

The drainage of lands, now held to be so important for agricultural and sanitary reasons, is very commonly injured or wholly prevented, from the want of proper culverts under roads.

The writer has often been told by Western farmers, living on lines of railroads, that they had at first been opposed to the roads crossing their lands as a serious damage, but that they had found that the drainage effected by the cuttings in the soil, more than compensated for the damage done by dividing up their fields. The building of a road, if properly managed, need at least be no injury to the drainage of lands, and in many cases should be a benefit.

Any person who has ever had experience in travelling upon our roads in their worst condition in the spring months of the year, will be thankful for any plan, within the public means, of making it comfortable ; and when the people of the State become convinced that the evil of bad roads is not necessarily insurmountable, a remedy of some kind, more or less effective, will be applied. If it were possible to present the contrast between the present imperfect roads and well-made ones to actual view, no one would hesitate to accept any practicable method of insuring the well-made ones. Could the people have a trial, for a day, of perfectly good roads, they would never again do without them, if means and skill within reach could command them.

The plan proposed in this paper is believed to be the best that can be offered, and is submitted with confidence to the consideration of the people and law-makers of the Commonwealth.

The State of Massachusetts is usually foremost in the march of improvement, and it is to be hoped that she will head the advance in this new way of progress, which so plainly leads to an increase of prosperity and a still higher grade of civilization.

The work lies straight ahead; and with the leadership of His Excellency the governor, and the ready response of the legislature, there is a fair promise that we shall soon achieve one of the greatest and most needed of public improvements—a grand and complete system of really GOOD COMMON ROADS.

DEDHAM, January 28, 1870.

INDEX

TO THE SECRETARY'S REPORT.

INDEX

TO THE ABSTRACT.